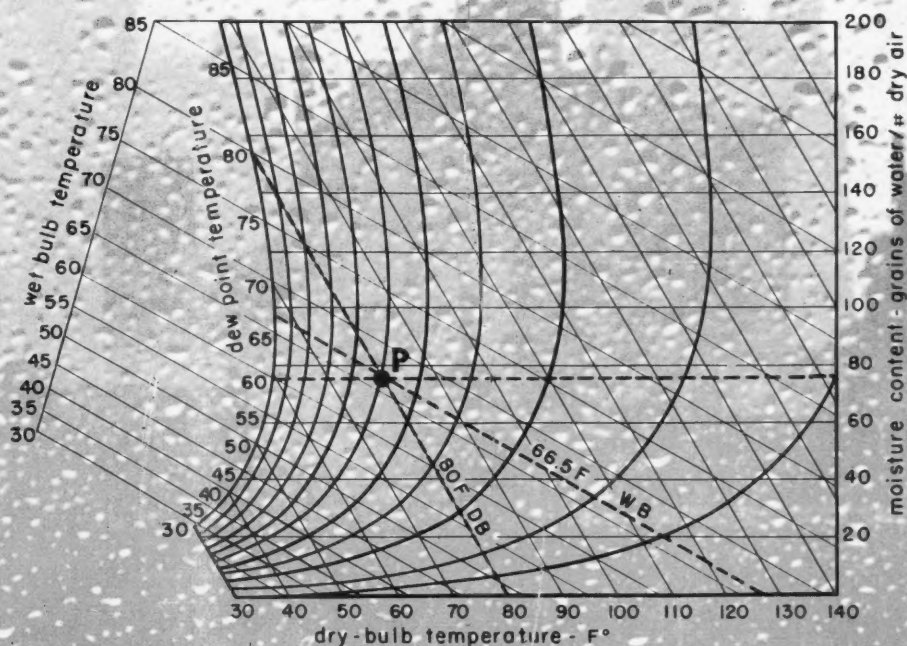


121 Design Engineering

FIVE DOLLARS A YEAR

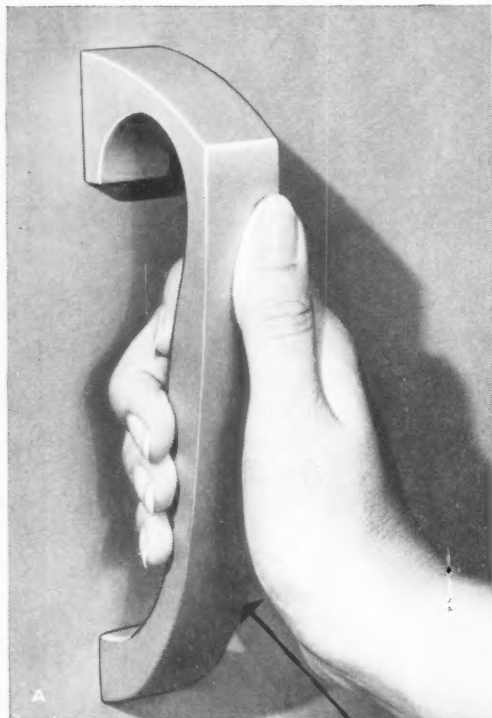
HUMIDITY — HOW IMPORTANT IS IT?



March 1957

Problems of infrared systems
Tubes grow fins for heat transfer

Open the door to new freedom in design with ALCAN ALUMINUM EXTRUSIONS

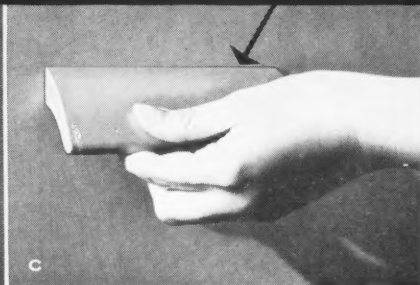
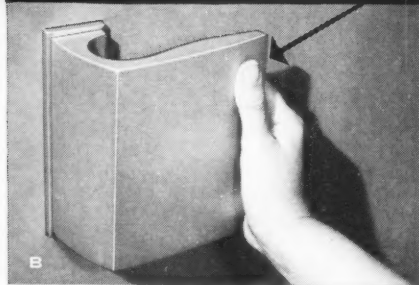
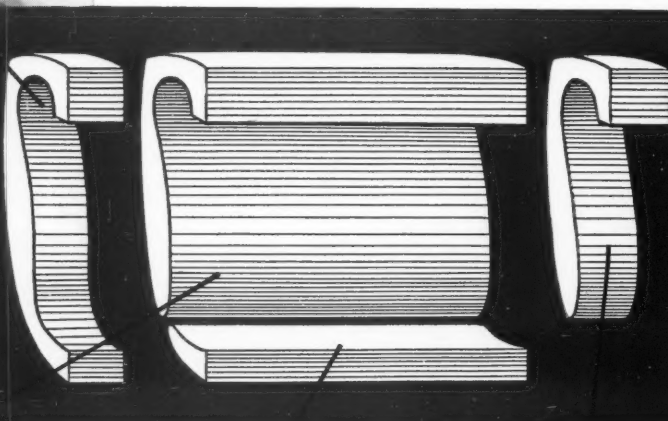


Offering a limitless variety of shapes and sizes, Alcan Aluminum Extrusions can help you improve your products and reduce costs.

Alcan aluminum extrusions have the uniformity and close tolerances that reduce assembly machining time. Labour, material and assembly costs are further cut because one-piece extrusions eliminate costly joining operations.

Alcan aluminum extrusions find a hundred and one applications in furniture, household appliances, machinery, motors, toys, and end products of all kinds. For full information on standard or special shapes to meet your requirements, call your Alcan Sales Office.

Here's a practical example* of the versatility of aluminum extrusions. 'A' - the basic one-piece extrusion cut to width for an attractive door pull. 'B' - the same extrusion modified and used in another width. 'C' - a section put to use as a drawer pull. 'D' - the modified version (B) cut to a thinner width for a lever handle.



*Developed for Raymond Manufacturing Company by Alcan.

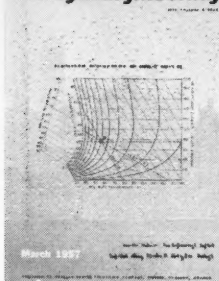
ALCAN

ALUMINUM COMPANY OF CANADA, LTD.

CALGARY HALIFAX HAMILTON MONTREAL OTTAWA
QUEBEC TORONTO VANCOUVER WINDSOR WINNIPEG

DESIGN ENGINEERING MARCH 1957

Design Engineering



Design Engineering

VOL. 3

MARCH 1957

NO. 3

This month's cover

Raindrops hung against a backdrop of big city skyscrapers makes the March issue cover. Searching for a way to do cover justice to Ed Campbell's feature article about humidity, artist Desmond English spent a lot of time experimenting with inks to get just the effect he wanted. The result deserves a close look. You're looking through a curtain of droplets caught on an office windowpane.

Design Engineering

MEMBER



Authorized as second class mail, Post Office Department, Ottawa.

Printed and published by Maclean-Hunter Publishing Company Limited, Editorial and Advertising Offices: 212 King Street West, Toronto 2, Canada. Address all correspondence: P.O. Box 100, Toronto, Canada. Horace T. Hunter, Chairman of the Board; Floyd S. Chalmers, President; Donald F. Hunter, Vice-President and Managing Director; Thomas H. Howse, Vice-President and Comptroller.

Publishers of National magazines in Canada: Maclean's, Chatelaine, Canadian Homes and Gardens, Business newspapers in Canada; Canadian Hotel Review; Fountains in Canada; Heating and Plumbing Engineer; Bus and Truck Transport; Canadian Advertising; Canadian Automotive Trade; Canadian Aviation; Canadian Grocer; Canadian Machinery; Canadian Packaging; Canadian Paint and Varnish; Canadian Printer and Publisher; Canadian Shipping; Canadian Stationer; Civic Administration; Drug Merchandising; Electronics Engineering; L'Espresso; The Financial Post; Hardware and Metal; Marketing; Men's Wear; Modern Power; Painting and Decorating Contractor; Plant Administration; Le Prix Courant; Electrical Contractor; Style; Office Equipment & Methods; Home Goods Retailing; Photo Trade; Building Supply Dealer; Business newspapers in U.S. and U.K.; Inland Printer, Rock Products, Concrete Products, British Printer.

OTHER SERVICES: The Financial Post Corporation Service; Canadian Press Clipping Service; Commercial Printing Division.

Offices at 1242 Peel Street, Montreal; Maclean-Hunter Limited, 125 Strand, London (Eng.).

Subscription rates: Canada \$5.00 per year, two years \$9.00, three years \$13.00. Single copy price, \$1.00. Other countries \$8.00 per year.

CONTENTS

Features

Unfiltered air can kill motors quickly	31
Infrared systems are design problems	33
Tubes grow fins to boost heat transfer	37
High speeds need dynamic balancing	40
Humidity has a big role in industry	47

Short features

These arc welds are sound and clean	46
Old drawings are starting a new life	62

Departments

Design news in pictures	44, 45
Editorial	80
File (literature offered)	66
Ideas round-up	52, 53, 54, 56, 58, 60
Letters from readers	68
New products	64, 70
People	29
Reports from industry	5
Society column	72

You get balanced

POINT
STRENGTH

SMOOTHNESS

BLACKNESS

WEAR

performance
from every

TURQUOISE PENCIL

thanks to
100% "Electronic Graphite"

Because each of the 17 TURQUOISE grades is made from a separate formula . . . and because each grade is both tried and true . . . TURQUOISE will give you exactly the line you want every time!

Unmatched smoothness in all degrees is the sure result of the extreme particle fineness to which its 100% "Electronic" Graphite is reduced in Eagle's patented, exclusive Attrition Mill.

Blackness is appreciably enhanced because thousands more of the super-fine "Electronic" Graphite particles are deposited at every stroke on the paper in denser lines that reproduce to perfection.

Longer wear is inherent because 100% "Electronic" Graphite and super-refined clay binder are combined at white heat into the most closely knit, even-wearing ceramic structure known in pencil leads.

SEND FOR FREE SAMPLE, mentioning this magazine and the grade of pencil you want.

EAGLE

"Chemi-Sealed"
(Super Bonded)

TURQUOISE

Drawing Pencils
and Leads

EAGLE PENCIL COMPANY
OF CANADA LIMITED
217 Bay Street
Toronto,
Canada

EAGLE "CHEMI-SEALED" TURQUOISE DRAWING

William Morse
B.Sc., A.M.I.Mech.E., A.F.I.A.S.,
A.F.R.Ae.S., P.Eng.
EDITOR

John Dennis
ASSISTANT EDITOR

Anthony Brian
MONTREAL EDITOR

George McKechnie
ADVERTISING REPRESENTATIVE

Stephen Danyluk
EASTERN REPRESENTATIVE

Desmond English
EDITORIAL LAYOUTS

John F. Foy
CIRCULATION MANAGER

J. W. Sargent
RESEARCH & PROMOTION MANAGER

W. A. Weir
ADVERTISING SERVICE MANAGER

Ronald A. Smith
MANAGER

George W. Gilmour
GROUP MANAGER,
INDUSTRIAL PUBLICATIONS

J. L. Craig
DIRECTOR, BUSINESS PUBLICATIONS

Editorial correspondents in: The
United Kingdom, the United States,
Germany, France and Italy.

In our next issue

The Kanigen plating process is a method of putting a nickel phosphorus coating on iron, copper or aluminum from a chemical bath without electricity. The April issue will carry a feature on the process. In the same issue look for articles on pressure measuring instruments, bifocal lenses and cerametallic materials.



Brown

The article in this issue on the manufacture and applications of the low finned heat transfer tube is the work of **Frederick Stewart Brown**, sales manager and v-p of the Unifin Tube Company. Brown, a Maritimer by birth, is a B.Sc. in chemical engineering from Queen's and a graduate in business administration from the University of Western Ontario. He was process design engineer with Polymer from '46 to '49 and joined Unifin in 1950. His appointment to vice-presidency in the company came in 1955.

When **Ed Campbell** (Humidity has a big role in industry) graduated from Rutgers University in 1952 with a degree in literature, his ambition was to become a free-lance feature writer. He set out to get basic experience as a newsman. A stretch with the U. S. Signal Corps put an end to this ambition when he found concentrated exposure to the electronics and technical world to his taste. After the Army he joined Brown Instruments as a copywriter and now supervises advertising and sales promotion for Brown.



Campbell



Gyurik

Stephan Gyurik was born thirty years ago in France. He graduated at twenty-one from the National Engineering School in Paris and a year later he had an aeronautical engineering degree from the time spent working at a French Navy specialization course. For three years (1949-51) he was aviation maintenance officer on a carrier and an engineer lieutenant in the French Naval Reserve. From carrier service he joined Sorel Industries Ltd. and, in 1954, became deputy chief designer for Jarry Hydraulics in Montreal.

If you want an authoritative article on a specialized subject you turn to the expert. Case in point is the author of our article on infrared materials. He is **Joseph Jerger**, senior glass engineer with the Servo Corporation of America. Jerger is a bachelor of both chemical and ceramic engineering from the University of Georgia. He divides up his 9 years of experience in this field as follow: 3 years research and development of optical glasses, 2 years in optical finishing procedures and 4 years infrared glasses.



Jerger

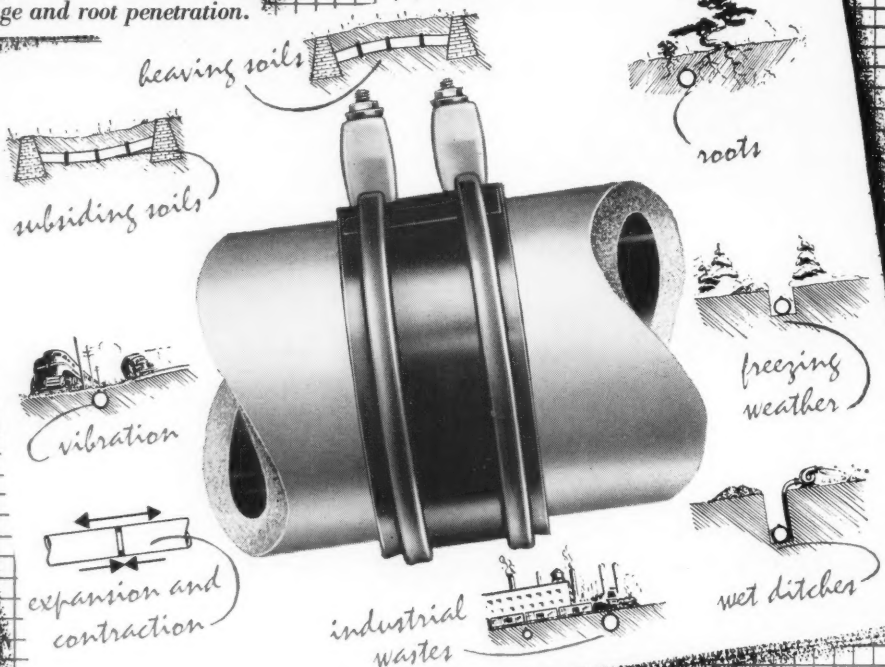
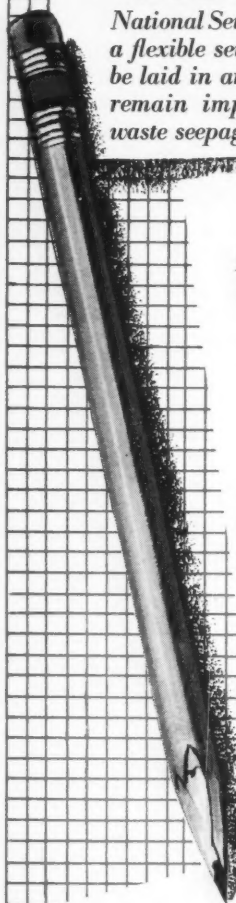


Rybb

A three-time contributor to Design Engineering (Noise measurement, stroboscopes and, in this issue, dynamic balancing) author **S. A. Rybb**, who is of Polish origin, emigrated to Canada in 1954. He graduated from London University in electrical engineering in 1949 and joined Dawe Instruments Ltd. He came to this country to work with the newly formed division of the company and is now its chief engineer. He served with the Allied Armed Forces during the war as a technical officer.

Problem

National Sewer Pipe Limited needed a flexible sewer coupling that could be laid in any kind of weather and remain impervious to industrial waste seepage and root penetration.



Solution

They chose Polysar Butyl 301. This special type of Polysar has high resistance to ozone, water, heat and cold—remains constantly flexible—and gives a pressure-tight fit unaffected by either sewage or soil attack.



The example stated here is just one instance of how Polysar rubbers and Polymer's research chemists write new uses for rubber into the diary of synthetic rubber. In countless industries Polysar synthetic rubber is making better rubber products.

If you have a technical problem it may well be that Polysar synthetic rubber holds the best answer. Write to our Sales and Technical Service Division, Polymer Corporation Limited, Sarnia, Canada.

POLYMER CORPORATION LIMITED
SARNIA • CANADA

NOTHING PERFORMS LIKE RUBBER — The best buy for your money

Reports

News in brief from the world's producers

Linde expands

Linde Air Products Co., Division of Union Carbide Canada Ltd., has announced plans to double production capacity of its oxygen plant at Welland, Ontario. The enlarged facilities are expected to be in operation early this year.

U. K. makes progress

Government and industry in Britain are progressing well in their recently announced five-year plan to double the number of scientists and technicians.

Speaking in Newcastle, **Sir David Eccles** announced that out of £70 million capital expenditure which has been granted, £40 million of building projects had already been approved. Eight colleges had been designated as colleges of advanced technology. Arrangements had been made for examination courses and scrutiny had taken place of the first applications received from technical colleges for recognition for the Diploma in Technology.

Glulam plant producing

Operating with all-Canadian capital, **Glulam Products Limited** has commenced manufacture of structural glued laminated beams and arches as well as roof-truss fabrication in one of the largest plants of its kind in the country. It is situated in New Westminster, B.C., on leased premises within the plant area of Canadian Western Lumber Co. Ltd.

Permanent magnets

Alnico permanent magnets are now being produced in the plant of **Indiana Steel Products Co. of Canada Ltd.** at Kitchen, Ontario.

"We have installed a complete line of specialized equipment for manufacturing quality magnets," says President Barnett, "and volume production is now under way." Stocks of standard Alnico magnets have also been set up to permit immediate shipment in experimental quantities.

Colored foam

An agreement to market vinyl foam in Canada has been completed by **Canadian Resins and Chemicals Ltd.** with General Foam Corp., New York, exclusive agents for all vinyl foam produced by Bolta Products, Lawrence, Mass.

As Canadian agent for General Foam's entire line of vinyl foam, CRC is the only source in Canada of this product in continuous roll form as well as made to order in any color in the almost limitless range in which vinyl can be pigmented.

Services in every field

A professional multi-facet engineering firm which provides services in every important engineering field was officially opened at its new office building in central Toronto on February 8.

This firm, **Federated Consultants Ltd.**, comprises 13 companies and consultants, and has offices in a half dozen Canadian centres as well as consultant representatives overseas. It is the largest private engineering group in Canada.

Reducing a year's engineering calculations to half a day by computers is one of the basic techniques that Federated Consultants will use in co-ordinating the work of their member and consultant firms when working on world-wide construction projects. Within the space of ten minutes for a small structure and two and a half hours for a large one, the computer serves up an answer to the bridge designer as to the accuracy of his preliminary design and assumptions, telling also what modifications, if any, are needed.

The name is Argus

The **Royal Canadian Air Force** and **Canadair** have chosen the name "Argus" for the new Canadair-built CL-28 submarine hunter and killer. The giant aircraft's name is, according to Greek mythology, well fitted.

Webster's dictionary gives two meanings to the word Argus: the first, "a 100-

eyed giant"—apt in view of the aircraft's myriad of detection devices, and the second, "a watchful guardian."

How many take mathematics?

The **Association of Professional Engineers of Ontario** is concerned with the "very real threat to the profession" in the form of a decline in the teaching standards of Ontario's high school mathematics and science teachers.

It was pointed out at a meeting that a recent survey of Ontario's high schools showed that, of 630 mathematics and science teachers, 400 had not taken maths and science beyond grade XIII.

Testing at 10,000 mph

A device for testing aircraft and missiles at airflows of 10,000 mph and temperatures of 9,000 deg. F for times far greater than before possible is being developed at **Cornell Aeronautical Laboratory**. The heart of the test facility will be the "wave superheater," a device developed by the laboratory.

Essentially, the wave superheater is a unique arrangement of tubes capable of producing a continuous flow of high-speed, high-temperature air. Outstanding feature of the design is its ability to operate at the extreme temperatures well beyond the melting point of all known materials.

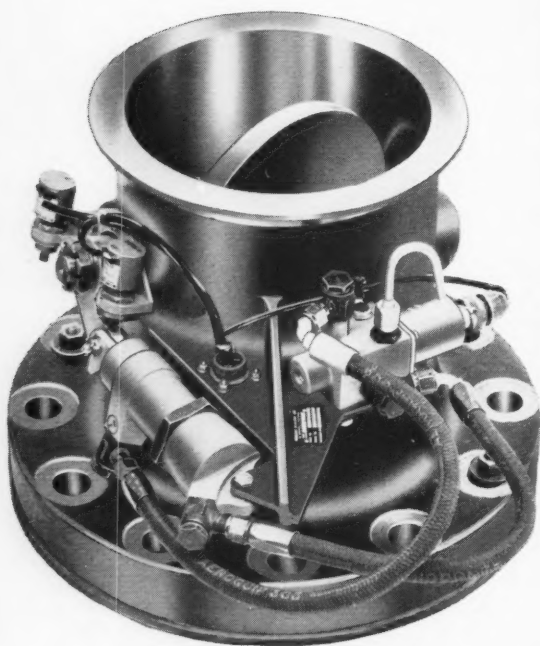
Strong aluminum

A new aluminum alloy so strong that a square inch could lift ten Cadillacs (a useful statistic?) has been developed by the Los Angeles Division of **North American Aviation**.

Called 42B, it greatly simplifies the job of producing intricate, completely formed missile parts in a single operation. See picture below.

Scientists who developed NAA's new aluminum alloy discuss a casting.





BUTTERFLY VALVE BODY

This guided missile component, type 304, A296-49T CF-8, had previously been fabricated. ESCO multiple-unit centrifugal casting technique (SPUNCAST®) was used, casting six valve bodies, each weighing 180 pounds, at one time resulting in an overall saving in time and material amounting to 30% of former costs.



Write today for your FREE copy of this informative 100-page reference book—"ESCO Alloy and Stainless Steels for the Process and Manufacturing Industries".

**Before you say,
"It can't be cast,"**

**call an ESCO
Engineer**

ESCO alloy steel castings can make your designing *easier*. You get the part you want, in the alloy you need and in the shape that saves you the most fabricating, machining and finishing time. **PLUS**

METALLURGICAL ENGINEERING AND RESEARCH

ESCO maintains one of the largest and best equipped metallurgical staffs of any alloy steel foundry... **PLUS**

PRODUCT ENGINEERING AND DESIGN

An integrated service at all levels; in the field, at the drawing board and in the foundry... **PLUS**

FOUNDRY FACILITIES AND CASTING EXPERIENCE

A casting service that covers the complete range of alloy steel casting methods for all applications... **PLUS**

LABORATORY INSPECTION AND TESTING

ESCO laboratory technicians are qualified and equipped to perform all types of inspections and testing to the most rigid specifications.

Call an ESCO Engineer — let him show you how ESCO Alloy Steel Castings can help make your designing easier.

8425 ONTARIO STREET, VANCOUVER, B. C.
2203 BEACONSVILLE AVE., MONTREAL, QUE.
32 TABER RD., TORONTO, ONT.

**PRODUCT
OF THE
YEAR**

*in the
electrical
industry*

**In the palm of your hand,
a new concept of
industrial controls...**



**CYPAK SYSTEMS
SUPPLY THE "BRAINS"**

to control a single machine or an entire
factory... the most revolutionary advance
in machine controls in a decade!

CYPAK

New Westinghouse development slashes automation costs

Not a single moving part—no springs to wear, contacts to erode, or tubes to burn out. This is the secret of CYPAK, the Westinghouse development that answers industry's demand for completely *reliable* machine controls.

CYPAK elements work 5 times *faster* and last up to 15 times *longer* than conventional relays. They reduce maintenance costs and simplify production. The end result of this Westinghouse development will be better

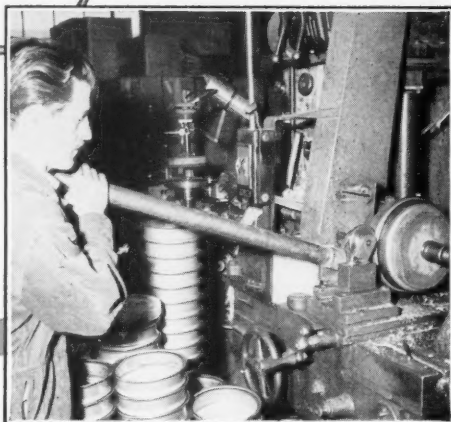
products, at lower prices, for *all* Canadians!

CYPAK—the Product of the Year—is an outstanding example of the complete Westinghouse line of machine tool controls. A sales engineer from your nearest Westinghouse office will gladly analyze and help to solve *your* control problems. Call him . . . or write Canadian Westinghouse Company Limited, Industrial Control Department, Hamilton, Canada.

WATCH WESTINGHOUSE!
WHERE BIG THINGS ARE HAPPENING TODAY!

Enjoy Television's Top Dramatic Show, Westinghouse **STUDIO ONE**, every Monday at 10:00 o'clock

UNIQUE AIR CYLINDER **TRIPLES** PRODUCTION for **Everingham Bros., Ltd., Toronto**



COMPANY: Everingham Bros., Ltd., Toronto, Canada.

OPERATION: Trim, curl and flatten drawn steel parts.

COMPONENT: Stainless steel cooking utensils.

OLD METHOD: The picture (right above) gives an idea of the back breaking effort once required to flatten and curl stainless steel cooking utensils. It took a 4' steel pipe as a lever and two husky hands to do the job. Production was slow and the extra operation of trimming had to be done on another machine.

NEW METHOD: Now, the compact, efficient machine shown above, built by the Acme Tool and Machine Co., performs all three operations of flattening, curling and trimming with push button cycling. The machine, built around three Bellows Air Motors and a Bellows Hydro-Check increased production three times over the old method and the operation is virtually fatigue-free.

The Bellows Air Motor is a unique air cylinder. It combines cylinder, valve, and speed controls in one compact unit, requiring only a single air line connection. It can perform hundreds of pushing, pulling, lifting and turning operations faster, easier, safer than a workman can do them by hand.

The Bellows Air Motor is but one of many Bellows "Controlled-Air-Power" work devices that can help you to secure more production at lower cost—as they are helping countless other Canadian manufacturers.

The dramatic story of Bellows Air Motors and other Bellows "Fluid Power" devices is found in the attractive and informative 4-color Bulletins ML-3 and BM-25. Packed full of design information, case history data, photographs and diagrams—these free Bulletins are yours on request. Write—Dept. DE 357



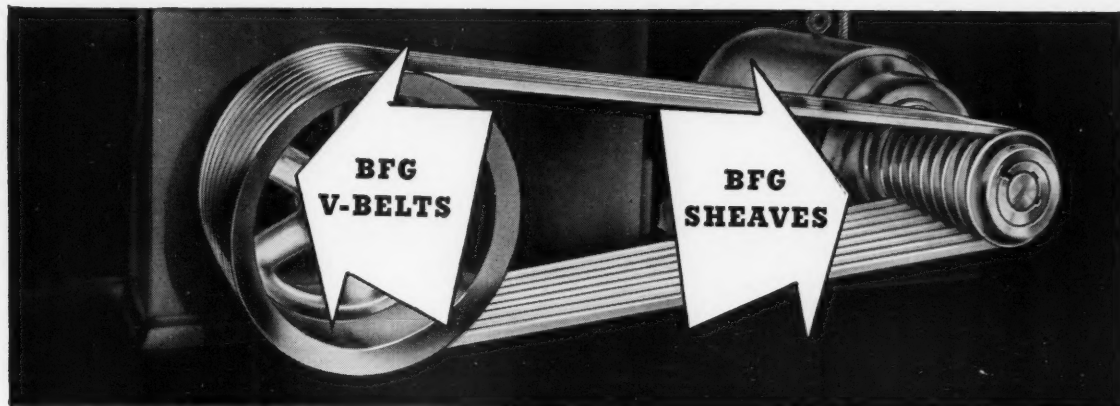
Bellows PNEUMATIC DEVICES OF CANADA, LTD.

14 Advance Road

Toronto, Canada

691B

B.F. Goodrich ANNOUNCES A COMPLETELY ENGINEERED V-BELT DRIVE!



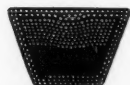
THE "PERFECT MATCH" TEAM FOR FULL POWER!

BFG GROMMET V-BELTS

Now, B. F. Goodrich offers you a "Perfect Match" team for greater power and longer V-Belt drive life.— New "Longlife" sheaves engineered for standard BFG grommet V-Belts or BFG High Capacity V-Belts.

Check these advantages:—

1. Standard B. F. Goodrich Grommet V-Belts give 20 to 50% longer wear. Twin grommets mean no centre cords, splice or overlapping cord sections . . . 67% less stretch . . . $\frac{1}{3}$ harder grip . . . and pull heavier loads with less internal heat, slip and surface wear.
2. B. F. Goodrich High-Capacity V-Belts have a 40% higher horsepower rating, which means 30% fewer belts and sheave grooves—a saving of over 20% on the cost of a drive. Heat-resisting and oil-proof covers eliminate 85% of V-Belt failures.



ORDINARY
V-BELT



STANDARD BFG
GROMMET V-BELT



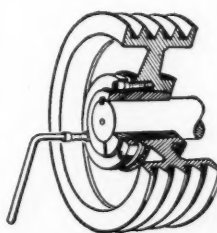
HIGH CAPACITY
BFG GROMMET V-BELT

B. F. Goodrich Canada Limited

MONCTON • MONTREAL • TORONTO • KITCHENER • WINNIPEG
REGINA • EDMONTON • CALGARY • VANCOUVER

BFG "LONGLIFE" SHEAVES

Engineered to be a "perfect match" team for B. F. Goodrich V-Belts. Split-taper bushings provide "full-circle" grip over the motor shaft. A small wrench is the only tool needed to mount and dismount "Longlife" Sheaves easily, and safely.



- **FULL CIRCLE GRIP** prevents backlash and play
- **EASILY ADJUSTS** to over or under sized shafts
- **CONSTANT TENSION** prevents sheave working loose
- **CLOSER MOTORING MOUNTING** reduces shaft strain
- **EASY INSTALLATION** saves time and costs



**INDUSTRIAL PRODUCTS
DIVISION**

VB-57-532

CALL YOUR B.F. Goodrich DISTRIBUTOR . . . "A Specialist in Rubber"

A copy for every designer

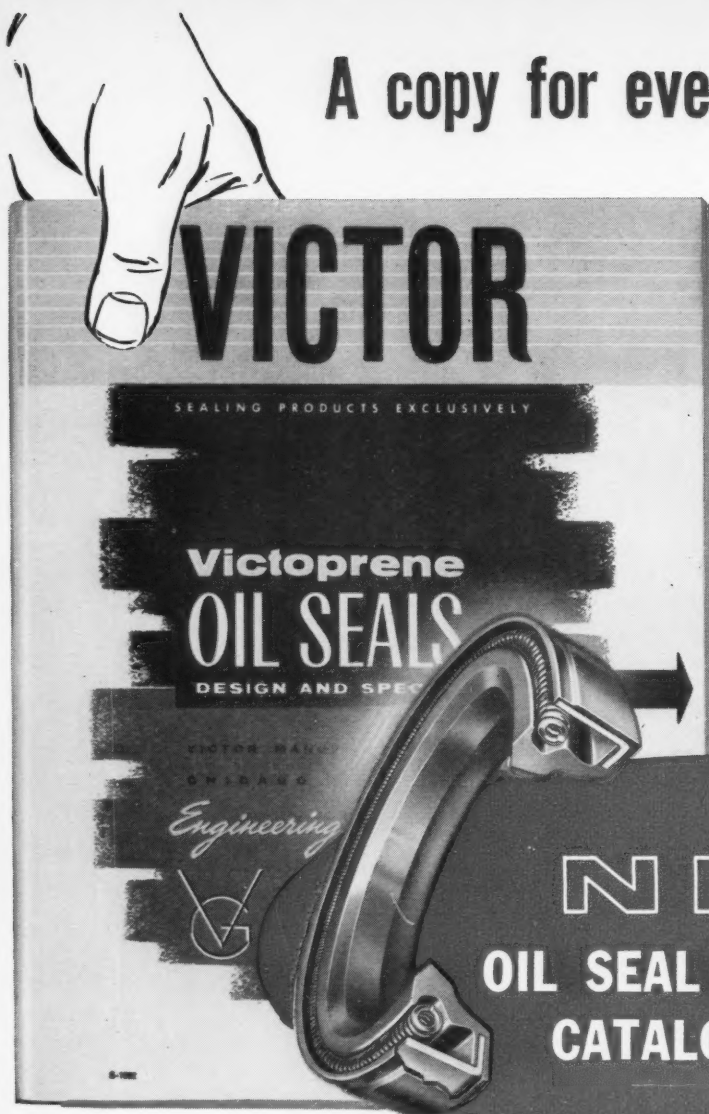


Table of Contents

Research and Development
General Product Description
S.A.E. Nomenclature
Metal-Encased Oil Seal Designs
One-Piece Molded Oil Seal Designs
Split Seal Designs
Victor Production Facilities
Victoprene Compounds
Synthetic Rubber Elastomers Chart
Applied Sealology
Peripheral Speeds Chart
O.D. Press Fit Chart
Application Design Features
Installation Data
Oil Seal Application Index
Seal Sizes and Types—by Shaft Diameter
Seal Sizes and Types—by Numerical Listing
Metal-Encased Felt Seal Listing

Compiled Entirely to Serve Specifier's Needs

You'll quickly see this is not just the usual reference catalog that tells you what you can have. Instead, this new, modern edition shows and tells you how to get the oil seal you need—and how to insure effective performance.

60-page working guide

Here you will find all essential data for modern oil seal specification procedure—much of it in useful form

for the first time in any catalog. Every section in the contents table offers valuable help toward better shaft sealing.

Note 2 outstanding features:

All sizes and types of Victor designs are grouped by shaft diameter—the primary consideration. A cross section of each design is immediately adjacent for quick reference.

Specific recommendations are given on design adaptability in

relation to pressure, temperature, and shaft speed conditions.

Your copy sent on request

The more you use this catalog, the more you will be impressed with the fact of Victor's pre-eminence in the quality oil seal field, both in meeting your standard as well as custom requirements.

Victor Mfg. & Gasket Co., of Canada Limited, St. Thomas, Ont. In the U. S.: Victor Mfg. & Gasket Co., P. O. Box 1333, Chicago 90, Ill.

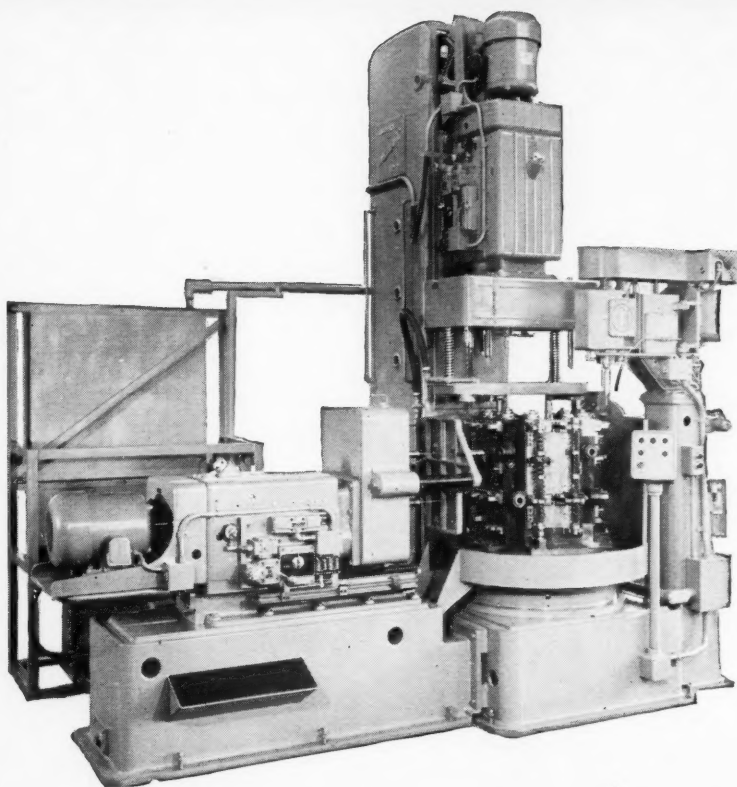
VICTOR

Sealing Products **EXCLUSIVELY**

OIL SEALS • GASKETS • PACKINGS • MECHANICAL SEALS

Another Special by

STANDARD-MODERN



FEATURES

- Economy of construction
- Rigid strength
- Correct drill speeds
- Accurate hole location
- Infinitely variable feed rates
- Completely automatic cycle
- Double work-holding fixtures
- Automatic lubrication

This Special Purpose Machine **DRILLS, REAMS and TAPS**
131 Automotive Cam Shafts per hour at 80% efficiency.

Developed by Standard-Modern, this high production Special Purpose machine drills, reams and taps oil holes in cam shafts at the rate of 26.4 seconds each.

Two cam shafts at a time are loaded vertically into rigid work-locating fixtures, where they are held by clips until manually clamped into accurate position. Pressing the cycle start button indexes the machine through its four work stations where hydraulic drilling, reaming and tapping units advance and feed to depth.

Loading and unloading is done at the first station while drilling, reaming and tapping operations are performed.

STANDARD-MODERN Special Machines are speeding production, saving time and money for industry across Canada.



STANDARD-MODERN
TOOL COMPANY LIMITED

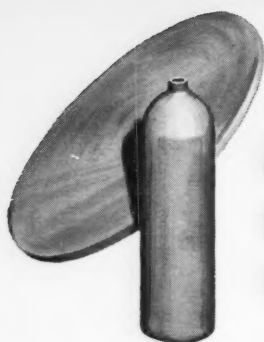
MANUFACTURING DIVISION

69 Montcalm Avenue, Toronto, Canada

• 3030 Walker Road, Windsor, Canada

SP-5

DESIGN ENGINEERING MARCH 1957



Flat Blanks to Finished Cylinders...

Higher Production Better Quality

one of the nation's
foremost producers of cylinders
for compressed gases
—NORRIS-THERMADOR CORP.—
uses Parker's aids to cold forming

The Bonderite and Bonderlube combination provides effective lubrication and acts as a non-metallic parting layer between work and dies. More severe deformations are possible, reducing the number of press operations and process anneals necessary. Die life is lengthened and surface finish improved.

Bonderite and Bonderlube, by more efficient lubrication, help plants reach new production levels, get more efficient and economical production, and achieve better, more uniform quality.

Parker's cold forming experience in many plants and on many products is available to apply on your cold forming problems at once. Write or call today.



PARKER RUST PROOF COMPANY

OF CANADA, LTD.

Rexdale Blvd., Rexdale (Toronto), Ontario

BONDERITE
corrosion resistant
paint base

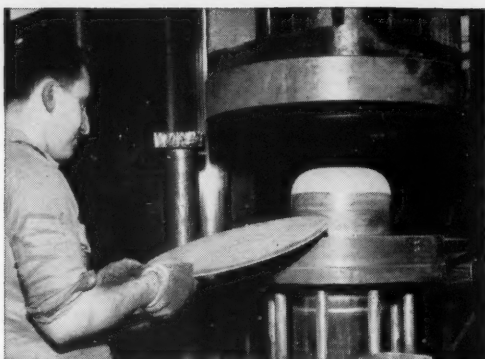
BONDERITE and BONDERLUBE
aids in cold forming
of metals

PARCO COMPOUND
rust resistant

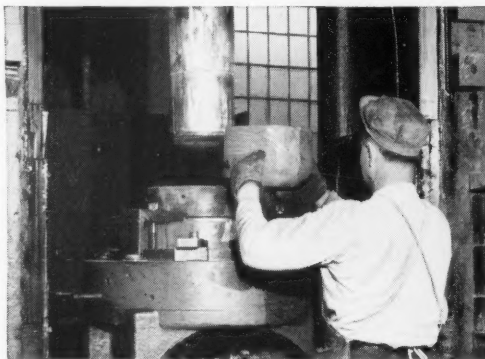
PARCO LUBRITE
wear resistant for friction
surfaces

TROPICAL
heavy duty maintenance
paints since 1883

*Bonderite, Bonderlube, Parco, Parco Lubrite, Parker Pre-Namel—Reg. U.S. Pat. Off.



Cupping: Flat CO₂ cylinder blank, treated with Bonderite and Bonderlube, is changed into cylindrical form, with maximum of about 45% reduction in diameter of blank.



First reduction: Diameter of cup is made smaller and length increased without major change in wall thickness.



Second reduction: Final diameter of part with respect to length determines number of reductions required. Photos courtesy NORRIS-THERMADOR Corporation, Los Angeles, California.

FREE TECHNICAL BULLETIN MAILED ON REQUEST

Illustrated technical bulletin "Bonderite and Bonderlube As Aids In Cold Forming" contains detailed information. Mailed free on letterhead request.

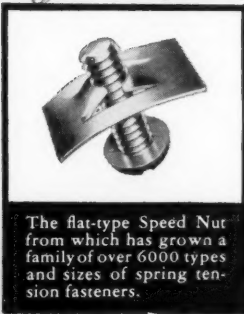
TINNERMAN

Creating Fasteners for Industry

An idea is born — and a problem solved

That's what is happening constantly at the Hamilton plant of Dominion Fasteners Limited, Canadian manufacturers of the famous line of **SPEED NUT** brand spring tension fasteners.

Through a combination of creative personnel and up-to-date facilities, this completely integrated Canadian company is able to create, develop and produce improved fastening methods for Canadian manufacturers. Whether you make automobiles or stoves . . . or any product that requires a fastening operation . . . there are greater profits for you with the **SPEED NUT** system of fastening.



The flat-type Speed Nut from which has grown a family of over 6000 types and sizes of spring tension fasteners.

TINNERMAN

Speed Nuts®

Exclusive Canadian Licensee Dept. D

DOMINION FASTENERS LIMITED, Hamilton, Ontario

a Geo. A. Tinnerman corporation



the Measurement of Industry...



Simpson INSTRUMENTS

With measurement an increasingly important function in industry — and Simpson instruments a major factor in the instrumentation field — then Canadian industry and Canadian made Simpson instruments have much in common.

Instrumentation is a complex field and requires, for solutions to industry's problems, the attention and facilities of specialists. That's just what we at Bach-Simpson feel we are — specialists, backed by complete Canadian facilities for manufacture, design and engineering of panel instruments.

If you have a problem in this field, let us have a look at it, regardless of how insurmountable it may appear. Others have — and found in Canadian made Simpson instruments the answers to their problems.



1255 BRYDGES ST.

LONDON, CANADA

IN U.S.A. SIMPSON ELECTRIC COMPANY, 5200 W. KINZIE ST., CHICAGO 44, ILL.

PLEASE VISIT US AT THE
I.R.E. CONVENTION



What is a "Good" Casting?

"Good" is the measure of performance. A good casting measures up—in performance—to all the requirements of its buyer and its end user.

If, during its life, it must withstand repeated thermal shocks, then it must be heat resistant; if it is going to be subjected to constant friction, then it must be wear resistant; if it comes into contact with salts or acids, then it must be corrosion resistant.

"Very true," you say, "and also very obvious. It is one thing to make fine castings to fit the job but can you make the price fit the castings? That's a requirement, too."

We can. That's where our Special Products Plant comes

in. It is run by experienced men, controlled by a first class laboratory and equipped with modern foundry equipment—it's an operation that's geared to meet quality and price requirements.

Our electric furnace, for example, allows flexibility, versatility and far greater uniformity of composition in the production of all types of iron.

The result: the best possible assurance against being let down half way through the machining operation. Your shop investment is thus protected.

So when you need "good" alloy castings, delivered clean and on time, order them from:

Canada Iron foundries, limited FOUNDRY & MACHINE DIVISION

HEAD OFFICE: 921 Sun Life Bldg., Montreal

TORONTO OFFICE: 171 Eastern Ave., Toronto

*Literature
is available on the
following engineering
irons and alloy irons
produced by our
Special Products
Plant:*

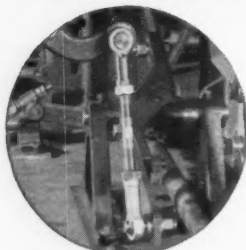
*If you would like valuable
information on any or all
of these irons, tick them
off and mail this coupon.*

NODULLOY ☐ **NI-RESIST** ☐
NI-HARD ☐ **DOMITE** ☐
NODULLOY NI-RESIST ☐

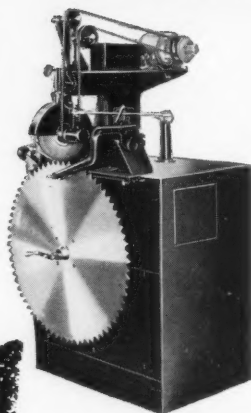
Your Name _____

Address _____

This linkage controls the shuttle motion of the label loom made by Fletcher Works of Philadelphia. This application visually demonstrates the ease with which misalignment can be corrected.



These applications demonstrate the self-aligning ability of the **HEIM Unibal**



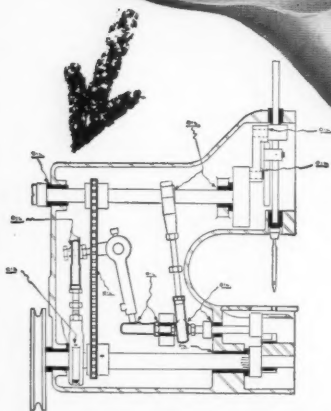
On this Armstrong Sharpener, which handles saws up to 120" in diameter, the push-pull rod with a Heim Unibal Rod End at each end, provides the universal motion for changing direction of the grinding wheel smoothly, quietly, and with precision for extreme sensitivity in grinding fine teeth.

Where shaft misalignment must be corrected . . .

The **HEIM** *Unibal* ROD END

is a single ball rotating in a bronze bearing race. It offers freedom of movement such as cannot be obtained with any similar mechanism. As a self-aligning bearing, it compensates for designed or unavoidable shaft or stud misalignment.

Because of the large area of contact between the ball and the bronze bearing inserts, much greater load ratings are possible for substantially smaller envelope dimensions.



The Minneapolis Sewing Machine Co. uses Heim Unibal Rod Ends to take care of a 25° operating misalignment in the linkages in their model H-150 portable sewing machine.

Please feel free to write our engineering department about your linkage problems, and be sure you have sufficient copies of the Heim catalog for all designing, operating, and purchasing departments.

R&M BEARINGS CANADA LTD.

QUEBEC CITY 755 Blvd. des Capucins MONTREAL 1006 Mountain St. WINNIPEG 1302 Notre Dame Ave. THREE RIVERS 375 St. Georges St. TORONTO 33&50 Edward St. VANCOUVER 1066 Seymour St. LONDON, ONT. 1024 Oxford St. East HAMILTON 130 Ferguson Ave. N.

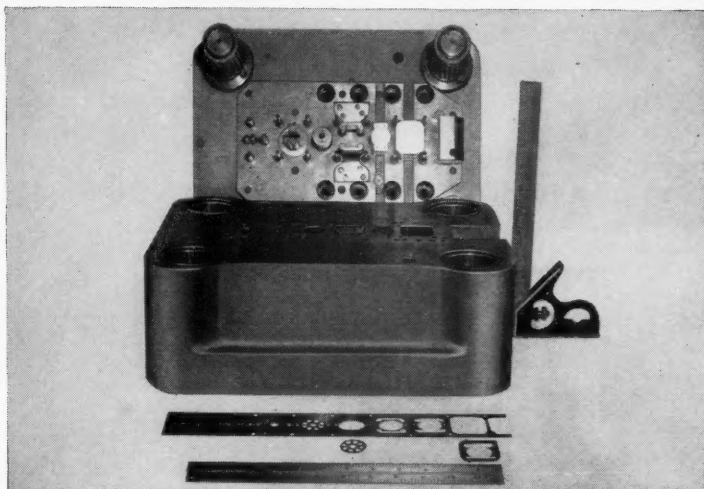
FACTORY REPRESENTATIVES AND DISTRIBUTORS FOR CANADA

ATLAS STEELS

ATLAS STEEL NEWS

TOOL STEELS • HIGH SPEED STEELS • MINING DRILL STEELS • SPECIAL PURPOSE STEELS • STAINLESS STEELS

Phenomenal Die Runs With Atlas NN



Pictured above is a die used by a well-known electrical appliance manufacturer to make lamination blanks from silicon strip. This die, made from the new Atlas NN steel, produced *four times* the number of pieces that were turned out by previous dies!

FIELD REPORTS SHOW DIE LIFE DOUBLED OR BETTER IN MANY CASES

Our metallurgical service department is receiving unsolicited reports from NN users who are getting greatly improved runs from dies made of our new NN stock.

These reports from customers claim double any previous die runs and in some cases up to several times previous runs.

Dies made from NN are able to turn out more pieces, because NN possesses the factors that are most important to a good die steel—namely excellent resistance to wear and abrasion. It's particularly suited to those applications possessing intricate design and for tools that must be hardened with a minimum of distortion or movement.

If there's a possibility of NN improving your die runs, why not talk to our district sales representative or metallurgical service de-

partment? They'd be glad to advise you on any metallurgical problem.

FREE... Decimal equivalent wall chart



Get a copy of this large (22" x 36") decimal equivalent chart for quick reference in your shop. Printed in large, legible type are the decimal equivalents of all common fractions. Write to: Advertising Department, Room No. E.1, Atlas Steels Ltd., Welland, Ontario.

TECHNICAL TIPS from your ATLAS Trouble-Shooter



How to prolong tool bit life . . .

Burning of the cutting edge of a tool bit during grinding can cause harmful surface stress or loss in hardness and wear resistance. The following procedures help you to maintain the cutting properties of the steel:

(1) Use the best grade 14" dia. grinding wheel.

	Type	Grit size	Bond	Grade	Hardness
Rough	Al Oxide	36	Rosenoid	N	
Finish	" "	54	Vitrified	O	

(2) The best speed range for a 14" dia. wheel is 4800 to 6500 S.F.M.

(3) Hold the tool bit firmly against the grinding wheel. Move back and forth slowly across the wheel face. Don't use too much pressure.

(4) Grinding wheels become clogged if not dressed regularly. True and dress all machine shop and tool room grinding wheels every day or two.

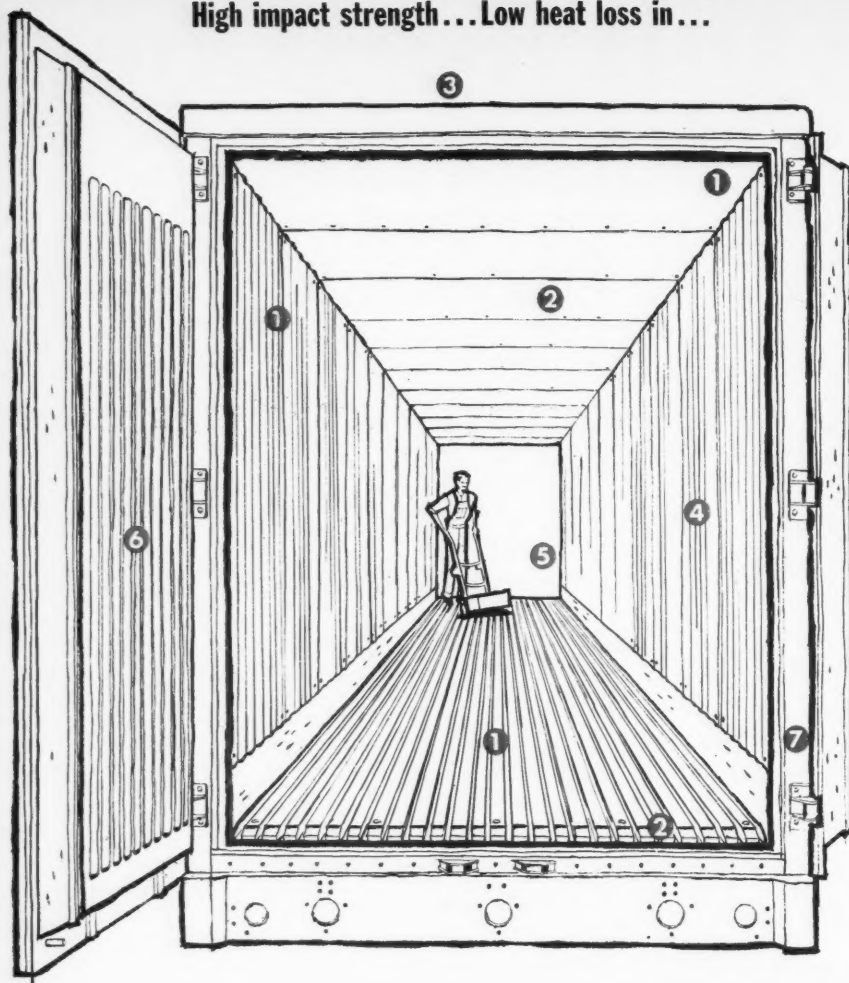
(5) Quench tool in a proper cooling medium as it becomes hot to the touch. Don't allow the tool point to develop heat color.

Finishing: A fine finish at the cutting edge improves tool performance and life. Using an aluminum oxide hone, hand hone after finish grinding. Hone away from cutting edge. To obtain optimum service from lathe tools, read the Atlas booklet "ATLAS TOOL BITS". For a complimentary copy of this booklet, write now, giving your name and address to: Advertising Department, Atlas Steels Limited, Welland, Ont.

ATLAS STEELS LIMITED WELLAND, ONTARIO

WAREHOUSES: MONTREAL, TORONTO,
HAMILTON, WINDSOR, WINNIPEG, VANCOUVER
REPRESENTATIVES IN LONDON,
ST. CATHARINES AND SUDBURY.

High impact strength...Low heat loss in...



1. Posts, roof bows and floor channels made of Strick Lamicor® from glass-reinforced RCI POLYLITE polyester resin. Not a single case of fatigue failure in two years of over-the-road testing.
2. Ceiling lining and shear sheets made by Strick from POLYLITE and glass cloth or mat laminates up to 50" x 100".
3. Translucent skylights of very high impact strength Lamicor made of polyester resin with 45% glass reinforcement.
4. Corrugated side linings (with or without slotted edges) made of fibrous glass-reinforced POLYLITE. Strick offers these panels with either vertical or diagonal corrugation.
5. Lining panels made of Strick Lamiclad® from POLYLITE and plywood laminates have excellent impact and cleaning properties.
6. Strick all-plastic trailer doors 4" and 6" thick made of reinforced POLYLITE resin in sizes up to 44" x 106".
7. Door framing made by Strick of reinforced POLYLITE in shapes up to 110" long.

Trailer components made by STRICK PLASTICS from RCI POLYLITE RESINS

● For two important reasons the Strick Plastics Division of Fruehauf Trailer Company, Perkasi, Pa., makes a wide range of trailer components from RCI POLYLITE polyester resin.

First, the strength-weight ratio of these reinforced polyester parts is superior to both aluminum and steel.

Second, the K-factor of heat loss through these plastic components is a small fraction of that for aluminum or steel. This advantage is especially important in reefer construction.

In "reefers", plastic components also eliminate the danger of cargo spoilage from wood stringers that have become rotted, pest-infested or odor-contaminated. Plastic parts made with POLYLITE resin do not rot or attract pests. They are durable and easily cleaned.

At RCI we have three lightweight, plastic trailers that were made for us by Strick. Entire exterior, interior and all structural members of these insulated vans are made of reinforced RCI POLYLITE polyester resin.

In small parts or something as big as a whole trailer POLYLITE construction can offer you advantages, too. Do you want lightweight strength? Durability? Easy maintenance? Bright built-in colors or translucence? Write to RCI about POLYLITE for your products. Ask for Booklet A. Reichhold Chemicals, (Canada), Ltd., 1919 Wilson Ave., (Weston), Toronto 15, Ont.

Creative Chemistry . . . Your Partner in Progress



REICHHOLD

VISIT THE RCI EXHIBIT BOOTHS 338-340

PACIFIC COAST

PLASTICS EXPOSITION



MARCH 18-21, 1957

SHRINE EXPOSITION HALL, LOS ANGELES

solve many difficult
control problems...use

OHMITE®

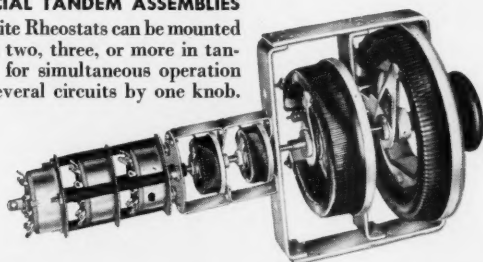
RHEOSTATS

with special features

Ohmite offers not only a line of *standard* rheostats but also rheostats with a wide variety of *special features*. Illustrated are only a few. All have the distinctive Ohmite design features: smoothly gliding metal-graphite brush; all-ceramic construction; insulated shaft and mounting; windings permanently locked in place by vitreous enamel. You will find the special rheostat feature you need in the dependable Ohmite line.

SPECIAL TANDEM ASSEMBLIES

Ohmite Rheostats can be mounted with two, three, or more in tandem for simultaneous operation of several circuits by one knob.



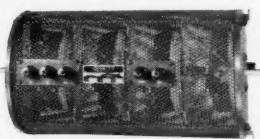
BUSHINGS FOR SPECIAL THICKNESS

Extra-long bushings and shafts for panels up to 2" in thickness. Seven bushing lengths.



SCREW DRIVER SLOT SHAFT

Shaft ends slotted for operation with a screw driver where few adjustments are needed.



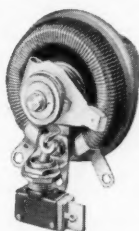
VENTILATED CAGES

Prevents mechanical injury to rheostat or human contact with electrically "live" parts.



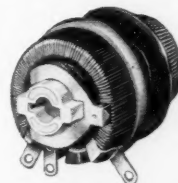
SENSITIVE SWITCH

Opens or closes circuit with minimum movement of control knob shaft. Extremely dependable long life switches.



TOGGLE SWITCH

Is operated with a positive snap by the rheostat arm at either end position. Used for heavy-duty applications.



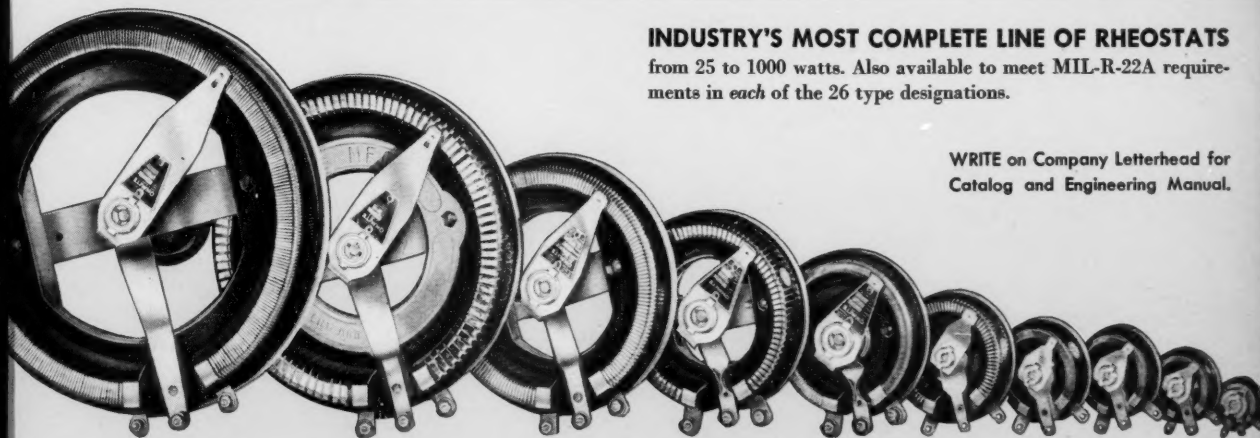
WITH OFF POSITION FEATURES

Opens circuit at high or low resistance position with *snap-action* (illus.); opens circuit at high resistance position with *dead lug off position*; or has *dead section off position*.

INDUSTRY'S MOST COMPLETE LINE OF RHEOSTATS

from 25 to 1000 watts. Also available to meet MIL-R-22A requirements in each of the 26 type designations.

WRITE on Company Letterhead for
Catalog and Engineering Manual.



RHEOSTATS • RESISTORS • RELAYS
TAP SWITCHES • TANTALUM CAPACITORS

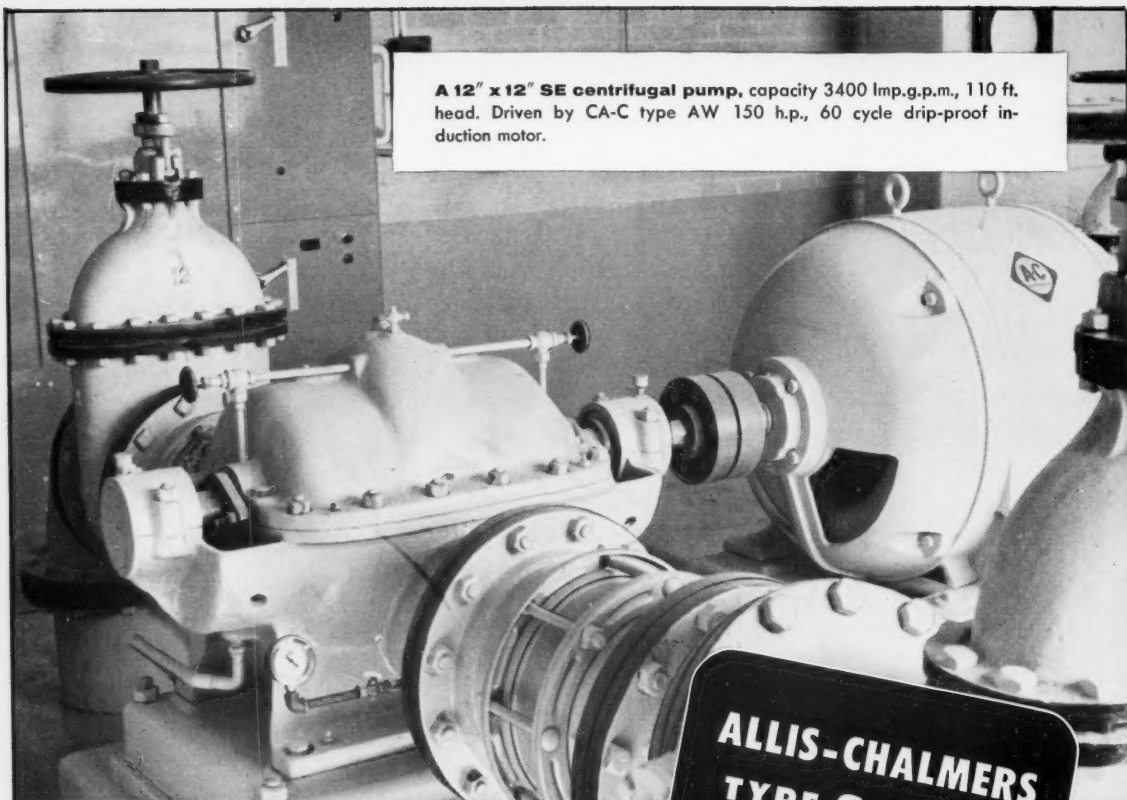
OHMITE®

OHMITE MANUFACTURING COMPANY, 3688 Howard Street, Skokie, Illinois

A. C. SIMMONDS & SONS
100 Market St., Toronto 12

C. M. ROBINSON COMPANY
189 Market Ave., East, Winnipeg 2

BE RIGHT WITH



A 12" x 12" SE centrifugal pump, capacity 3400 Imp.g.p.m., 110 ft. head. Driven by CA-C type AW 150 h.p., 60 cycle drip-proof induction motor.

ONE OF 10 CA-C PUMPS CHOSEN FOR THE

CITY OF LETHBRIDGE

by men who look beyond the price tag for built-in dependability

**ALLIS-CHALMERS
TYPE S PUMPS
AND MOTORS**

Another municipal installation of CA-C's type 'S' pumps and motors was recently completed at the reservoir and powerhouse in Lethbridge, Alberta. Here are some of the reasons for the wide acceptance of these single stage, double suction pumps by municipal authorities and industrial users across the country:—

- **High Efficiency** Each pump is custom-built for its specific application, the exact dimensions and type of impeller being selected on the basis of Allis-Chalmers' many years of experience in pump installations.

- **Less Power Consumption** Because the operating characteristics of the pump are so precisely tailored for the job it has to do, wastage of power is considerably reduced. When driven by an Allis-Chalmers "matched" motor, the Type S pump offers the lowest operating costs attainable today.

- **Easy Maintenance** Rotating element can be removed without disturbing piping or motor; easy access to packing; low cost replaceable parts at all points of wear.

- **Rugged Design** Long heavy casing support dampens vibration and reduces distortion. Ample strength is assured by generous use of metal at strategic points.

- **"CA-C Package Deal"** The pump can be supplied by CA-C complete with motor and control of co-ordinated design and manufacture. This means one responsibility, one guarantee of satisfaction.



If your need is for dependable, low-cost operation, consider the CA-C type 'S' pump. Available in a wide range of sizes with nozzles from 1" to 48".

For further information, contact your nearest CA-C office, or write direct to Canadian Allis-Chalmers Limited, P.O. Box 37, Montreal, P.Q.

MADE IN CANADA

CANADIAN ALLIS-CHALMERS

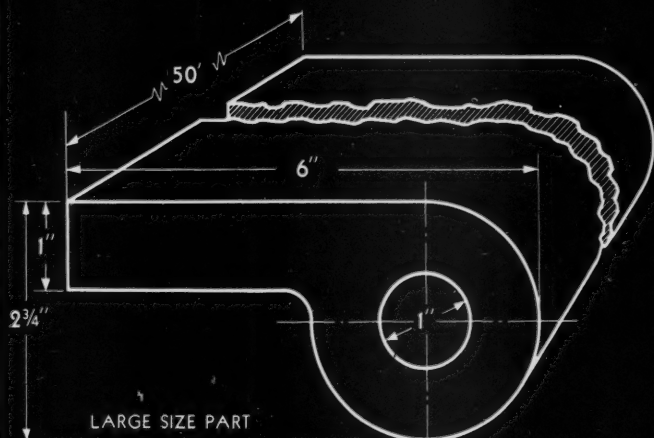


56-P-3



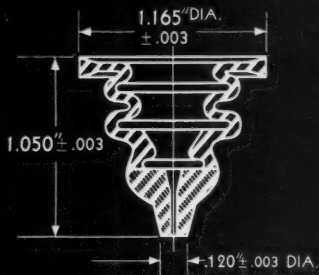
Engineered and Precision Molded Products

Dominion Rubber's engineers will work with your designers to solve your production problems

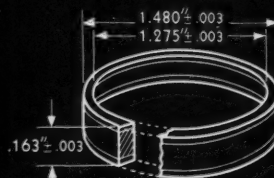


LARGE SIZE PART

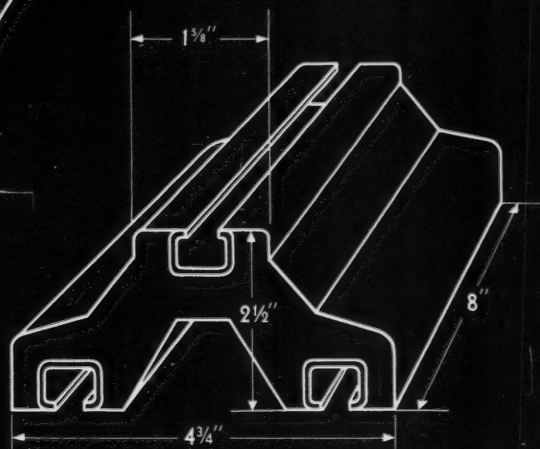
ST. LAWRENCE SEAWAY GATE SEAL



SMALL INTRICATE CLOSE TOLERANCES PART
COMBINATION OF TWO TYPES OF RUBBER USED



WATER PROOFING RING — RUBBER TO METAL
PRECISION PARTS FOR
INDUSTRY AND ARMED FORCES



RUBBER TO METAL — PAPER MACHINE MOUNTING

Dominion molding experts have the "know how" and the facilities to engineer molded products to meet your most rigid specifications — from the smallest of precision parts to complete products of any size.

Dominion Rubber expertly molds engineered rubber and plastic parts to suit your service requirements and provide the right balance of properties, such as tensile strength, resiliency, resistance to acids, solvents and other chemicals.

And Dominion Rubber makes them to perform most efficiently over a broad range of temperatures.

Another Product of Progress for Canada's Growing Industries



Dominion Rubber

Mechanical Goods Division

PART
USED

RUBBER COMPARATOR

TYPE OF RUBBER	TENSILE										AGEING PROPERTIES										RESISTANCE TO FLEX- CRACKING										
	Modulus	Elongation	Tensile	Compression	Recovery	Compression	Recovery	Compression	Recovery	Compression	Recovery	Compression	Recovery	Compression	Recovery	Compression	Recovery	Compression	Recovery	Compression	Recovery	Compression	Recovery	Compression	Recovery	Compression	Recovery	Compression	Recovery	Compression	Recovery
G. E. S.	0.94	400	3500	P	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F
Natural Rubber	0.95	2000	4500	G	F	P	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G	F	G
Styrene-B.	1.00	400	3500	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F
Neoprene	1.25	2000	2000	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F
Thiokol	1.25	200	1500	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G
Butyl	0.91	2000	2000	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G	F	P	G
Silicone	1.25	800	1000	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F	G	P	F

Selection of rubber for use in various applications can be made by comparing techniques.

IMPORTANT NOTE: These are general properties. Within any one group modifications can be made by compounding techniques.
 *Group Abbreviations: P= Poor, F= Fair, G= Good, V= Very Good, M= Medium, T= Terry Low, H= Extra Low, L= Low, P= Poor
 L= Excellent, G= Good, T= Fair, VG= Very Good, M= Medium, T= Terry Low, H= Extra Low, L= Low, P= Poor

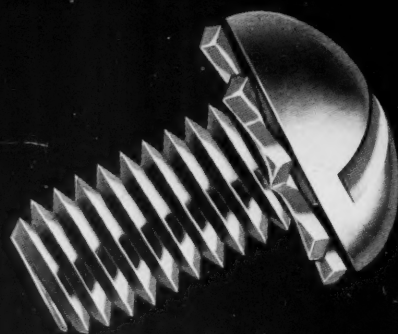
IMPORTANT NOTE: These are general properties. Within any one group, modifications can be made by compounding techniques.
 * Except Aromatic — Poor
 E. Excellent, G. Good, F. Fair, VS. Very Good, M. Medium, V. Very Low, SL. Extra Low, L. Low, P. Poor

Pre-assembled

to cut your

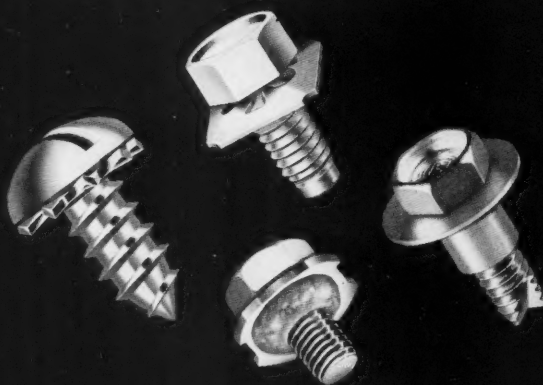
Costs

...by eliminating handling
of multiple parts



SEMS-BY-SHAKEPROOF

Pre-assembled Screw
and Shakeproof® Lock Washer



Even greater cost-savings are possible with Sems-by-Shakeproof through variations in threads, points, heads, and washers, or with the addition of sealing compound or special sleeves.

• You handle one unit instead of two or more with Sems-by-Shakeproof • Every lock washer is factory-matched • Lost and forgotten washers eliminated • Available in variety of screw and lock washer combinations, multiple-piece assemblies and with mastic sealants.

Send for Sems-by-Shakeproof sample kit today



SHAKEPROOF-FASTEX

"FASTENING HEADQUARTERS"®

DIVISION OF CANADA ILLINOIS TOOLS LTD.
TORONTO, ONTARIO



A complete tubing service working for you

- DESIGN ENGINEERING
- MANUFACTURING
- QUALITY LAB-TESTING

Standard Tube & T. I. have a fully experienced group of design engineers who will work with you in the designing of new products or the improving of existing ones.

Modern manufacturing facilities and thousands of man years of tubing experience have made Standard Tube & T. I. the largest fabricator of welded steel tubing in Canada.

Quality is important at Standard Tube. To keep quality at its highest, a completely equipped laboratory makes continuous tests ranging from analysis of the raw stock to examination of in-use operation of finished pieces.

STANDARD TUBE STANDS
FOR ALUMINUM, TOO!

Sheet, Bar, Extrusions, Tube
and Wire—available
in any quantity.

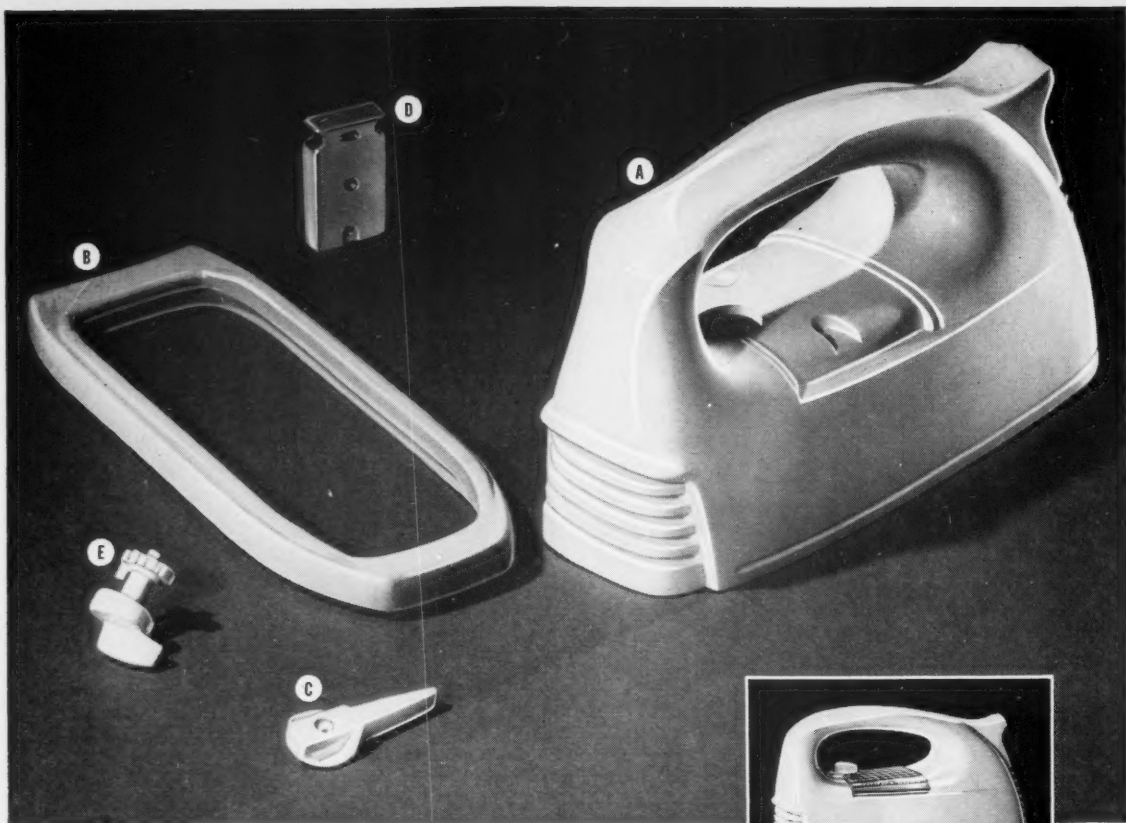


STANDARD TUBE AND T. I. LIMITED

WOODSTOCK • TORONTO • OTTAWA • MONTREAL

WELDED AND SEAMLESS STEEL TUBING • FABRICATIONS •
ALUMINUM • MATERIALS HANDLING EQUIPMENT • SCHOOL AND NESTING FURNITURE

Member of Formed Steel Tube Institute



Why five plastics were used in one food mixer?



C.G.E. has discovered that in most instances a combination of plastics turns out the finest, yet most economical, finished product. For instance five different plastics properly molded were used to produce this popular food mixer.

There are many advantages in having C.G.E. solve your plastic molding problems. We have the facilities to fabricate any type of plastic material and the know-how as to what plastics to use. Call C-G-E Plastics Advisory Service. They will co-operate with your engineering, production and sales people to give your line added sales punch. Contact: Plastics Advisory Service, Canadian General Electric Co. Ltd., Cobourg, Ontario.

A — MOTOR ENCASMENT in Herculon Acetate. Fire and break-resistant . . . gleaming white finish. Resists food and fruit juice stains.

B — GASKET in Vinyl Plastic. Had to be exceedingly flexible. Resistant to oils and fats . . . easily cleaned.

C — EJECTOR LEVER in Urea Plastic. Very sturdy . . . in white . . . shows no wear though beaters are inserted and ejected constantly.

D — SWITCH BASE in Phenolic Plastic. Low cost . . . high dimensional stability . . . noted for its electrical properties.

E — CONTROL KNOB in Hy-impact Polystyrene Plastic. Very tough . . . in white . . . ideal for this part that is frequently handled. Low in cost.



**Custom-Molded
PLASTICS**

Plastic Works — Cobourg, Ont.
INDUSTRIAL PRODUCTS DEPARTMENT

451W-355

CANADIAN GENERAL ELECTRIC COMPANY LIMITED



Aeroquip Hose Lines with Reusable Fittings —the Answer to Hydraulic Design Problems

HUNTINGDON INDUSTRIES USES AEROQUIP ON AUTOMATIC ASSEMBLY MACHINERY

Aeroquip Hose Lines simplify fabrication of complex hydraulic systems on automatic partition assembling machinery made by Huntingdon Industries. With Aeroquip Bulk Hose and Reusable Fittings, Huntingdon personnel assemble hose lines of any length quickly, easily, using ordinary bench tools.

Simplify your hydraulic design problems with these Aeroquip Hose Lines: 1509 Hose for petroleum and water base systems up to 5000 psi.; 1503 and 1502 Hose for petroleum and water base systems up to 3000 psi.; 1546 Hose for fire resistant phosphate ester base systems up to 5000 psi.; 1532 Hose for fire resistant phosphate ester base systems up to 3000 psi. Write for full information.



Aeroquip Flexible Hose Lines are easy to install, even in confined spaces as the hydraulic positioning table on this automatic partition assembler.



Using Aeroquip Bulk Hose and Reusable Fittings, hose lines of standard or varying lengths can be made up quickly by Huntingdon personnel.

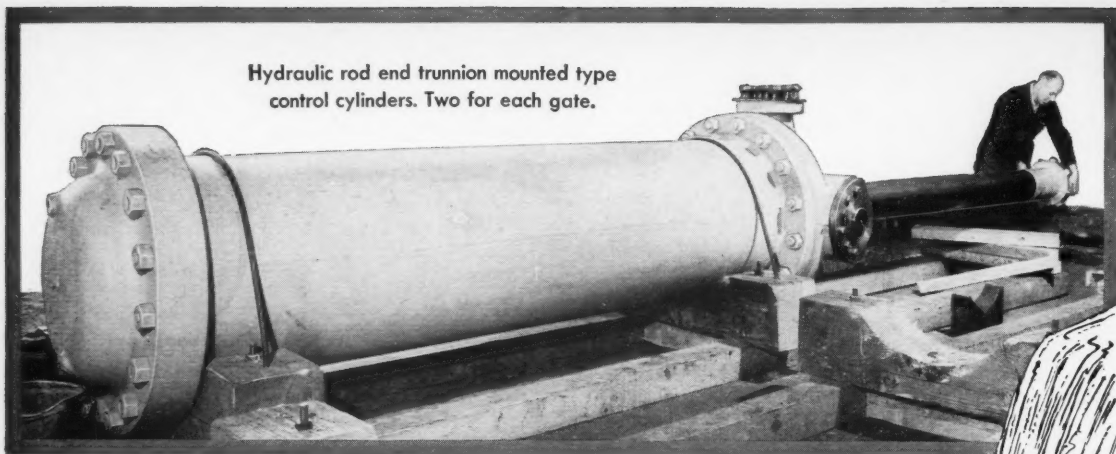


On this hydraulic motor, Aeroquip Hose Lines give long dependable service. When replacement lines are needed, they can be made quickly.

 **Aeroquip**
REG. TRADEMARK

AEROQUIP (CANADA) LTD., 287 BRIDGELAND AVENUE, TORONTO 10, ONTARIO
REPRESENTATIVES IN PRINCIPAL CITIES IN CANADA. AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN CANADA, U.S.A. AND ABROAD

Hydraulic rod end trunnion mounted type control cylinders. Two for each gate.



CONTROLLING THE FLOW OF NIAGARA

The flow of Niagara, one of Canada's greatest sources of electric power, is controlled by Vickers-built submersible gates of the "fishbelly" type.

Working with the M.A.N. Company, a Canadian Vickers associate, who designed the 100 ft. wide section welded gates, thirteen gates were supplied along with twenty-six servomotors and thirteen pumping sets which were entirely engineered by Canadian Vickers.

These gates are another example of the precise engineering that goes into all Vickers-built water control equipment.

Upstream View of gates during erection



CANADIAN
VICKERS
MONTREAL LIMITED

Toronto MONTREAL Vancouver

A Member of the World-Wide Vickers Group.

Wagner

repulsion start motor with
brushes and commutator

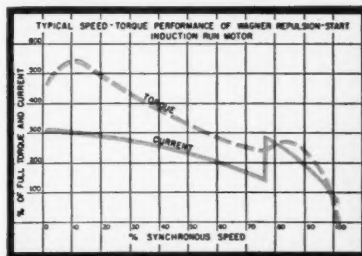


assures...

HIGH STARTING TORQUE LOW STARTING CURRENT

Here's a motor specially-designed by Wagner to give you high performance *even under varying voltage conditions*. Wagner Repulsion Start Motors guarantee *high* starting torque with *low* starting current. Check the Torque, Speed, Current Curves at the right for positive proof of the definite high performance of these remarkable Repulsion Start motors.

You'll find a complete range of Wagner Repulsion Start motors from $\frac{1}{4}$ H.P. to 5 H.P. If you wish further details, a qualified Wagner engineer will gladly analyze your requirements and recommend the Wagner Motor best suited for your needs.



SPEED - TORQUE PERFORMANCE CURVES

Wagner

ELECTRIC

Head Office:
LEASIDE, ONTARIO

Division of:
SANGAMO COMPANY LIMITED
PLANTS: LEASIDE, ONT.; THREE RIVERS, P.Q.

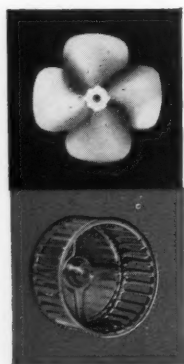
Sales Offices:
TORONTO • MONTREAL • WINNIPEG • EDMONTON
Also sold by Northern Electric Co. Limited

TORRINGTON PRESENTS:

An important new line of complete blower units for central air conditioning, heating and ventilating, in a wide range of sizes, full and three-quarter widths, and incorporating the following exclusive Torrington features:

1. An exceptional new Center-Lock airotor introducing an entirely new principle of blower wheel construction in which (see insert) the center disc is dove-tailed under pressure into the encircling blades. As a result of this design feature, the interlocking joint *tightens* under centrifugal force, eliminating blade rattle and angle warp at high speeds.
2. A Multi-Position blower housing, easily adaptable to left or right, up or down flow requirements, of the finest welded steel construction and special finish.
3. Availability in either belt-driven or direct drive assemblies.
4. Unit flexibility, providing feet, motor mounting assembly to meet your individual mounting requirements.

This new product line is a major development backed by all the standards of engineering quality consistent with Torrington leadership in the air impeller industry. Your inquiries are invited.



THE
TORRINGTON
MANUFACTURING COMPANY
OF CANADA LIMITED
OAKVILLE, ONTARIO
TORRINGTON, CONNECTICUT · VAN NUYS CALIFORNIA

People

Important people who are in the news

Vickers appointments

Vickers prexy Packham recently announced the appointments of **C. T. Muirhead** as technical manager of engineering sales and **T. J. Farrell** as manager of the company's central region. Muirhead has been project engineer and, for the last four years, manager of the Toronto office. Farrell has been production engineer and latterly sales engineer.

New positions for three at Bepco

F. E. Regan, **J. H. Adamson** and **E. B. Nicolle** were recently announced as, respectively, president, director and Montreal district sales manager of Bepco Canada Ltd.

Regan has been with the company since 1933 (its inception) and was originally Ontario manager and latterly vice-president and assistant general manager.

Adamson, a graduate of Glasgow University in electrical engineering, joined Harland Drives Ltd. in London in 1947 and brings valuable experience with this company to Bepco's board.

Nicolle has a background of 30 years in the electrical industry and has been the company's sales engineer in the province of Quebec for over 15 years.

Consolidated names Leckie

Air Marshal Robert Leckie, RCAF (retd.), has been named by Consolidated Diesel Electric as its Ottawa representative. Leckie, formerly aide-de-camp to King George V, King Edward VIII and King George VI, retired from the RCAF in 1947. During the First World War he served with naval forces in reconnaissance, antisubmarine and antizepelin duties, transferring to the RAF in 1918. Between the wars he was director of civil flying operations in Canada and, in addition to tours of duty with Royal Navy aircraft carriers in the Mediterranean and China Seas, was director of training for the RAF.

At the outbreak of World War II Air Marshal Leckie was in command of the RAF in the Mediterranean and had his headquarters in Malta. Early in 1940,

he was again loaned to Canada to serve as principal architect of the British Commonwealth Air Training Plan, as member of the Canadian Air Council for Training, and finally as Chief of Air Staff, RCAF.

Two Dominion Engineering managers

Mr G. Ewing Tait has been appointed manager of the recently created roll division of Dominion Engineering Co. Ltd. In his new position he is responsible for the development and marketing of chilled and alloy iron rolls and related products in the processing of metals, paper, rubber, plastics and grain. In addition, Tait is responsible for all metallurgical operations within the company.

Mr. A. K. Durrell, until recently manager of production planning and control with Dominion Engineering, has now become manager of foundries. Durrell joined the company in 1945 after service with the RCNVR and since then has had considerable experience in various areas.

AEL's three sales managers

Three supervisors at Aviation Electric Ltd., Montreal, have been appointed assistant sales managers of their departments to further the company's current expansion program.

They are: **Christopher N. Watts** — instruments and electronics division; **C. Durham Garbutt** — mechanical accessories division; **A. Jack Warwick** — manufacturing division.

B. C. firm gets general manager

Blair W. Anderson, P.Eng., has been named general manager of the British Columbia firm of Power Machinery Ltd.

Anderson, a graduate of the University of British Columbia in mechanical engineering, has recently returned from the east where he had extensive production and management experience as assistant production manager for Canada for the St. Regis Paper Co. (Canada) Ltd.

Hale becomes v-p, sales

The appointment of **George M. Hale** as

vice-president, sales, has been announced by Canadian Resins and Chemicals Ltd.

Hale, general sales manager for the past year, joined the company in 1946 on graduating from Queen's University. Engaged in development work at the laboratories in Shawinigan Falls and in technical sales at the Toronto district office for several years, he became assistant manager of the industrial products division at the Montreal head office in 1953. Two years later he was appointed manager of the division.

Chief engineer with Atlas

The promotion of **T. J. Nolan** to the position of chief engineer at Atlas Steels Ltd. was announced recently. Nolan graduated from the University of Toronto in electrical engineering in 1938 and for the next two years worked for the Ontario Hydro Power Commission. In 1940 he joined the Chemical Construction Corp. (now North American Cyanamid) and in 1943 moved to Atlas Steels Ltd. He has been assistant chief engineer since January 1956.



Gold medal for an engineer grad.

The Association of Professional Engineers of Ontario recently presented its Gold Medal award to the two engineering students who graduated with the highest standing from the University of Toronto and Queen's University during 1956. The two recipients were **Alonso R. Snyder** of Queen's and **Robert J. Fitzgerald** of U. of T. Snyder is seen above receiving his gold medal from Association president Fox. Fitzgerald is taking postgraduate studies at MIT, Cambridge.

Adamson



Anderson



Durrell



Nicolle



Regan



Tait





1500

formulations for industry



If you have two or more surfaces to join, there's a "3M" Adhesive that will do it faster, cheaper and more securely. If there's a surface to protect from mechanical damage, fumes, etc., during processing or shipping, there's a "3M" Coating or Sealer to do the job. Just state your needs.

*Write and let us
prescribe the formulation*



ADHESIVES COATINGS SEALERS

**MINNESOTA MINING & MANUFACTURING OF CANADA LIMITED
LONDON • CANADA**

Sales Offices: Halifax • Montreal • Toronto • Winnipeg • Saskatoon • Calgary • Vancouver
Resident Salesmen: Moncton • Quebec City • Ottawa • Hamilton • North Bay • Regina • Edmonton

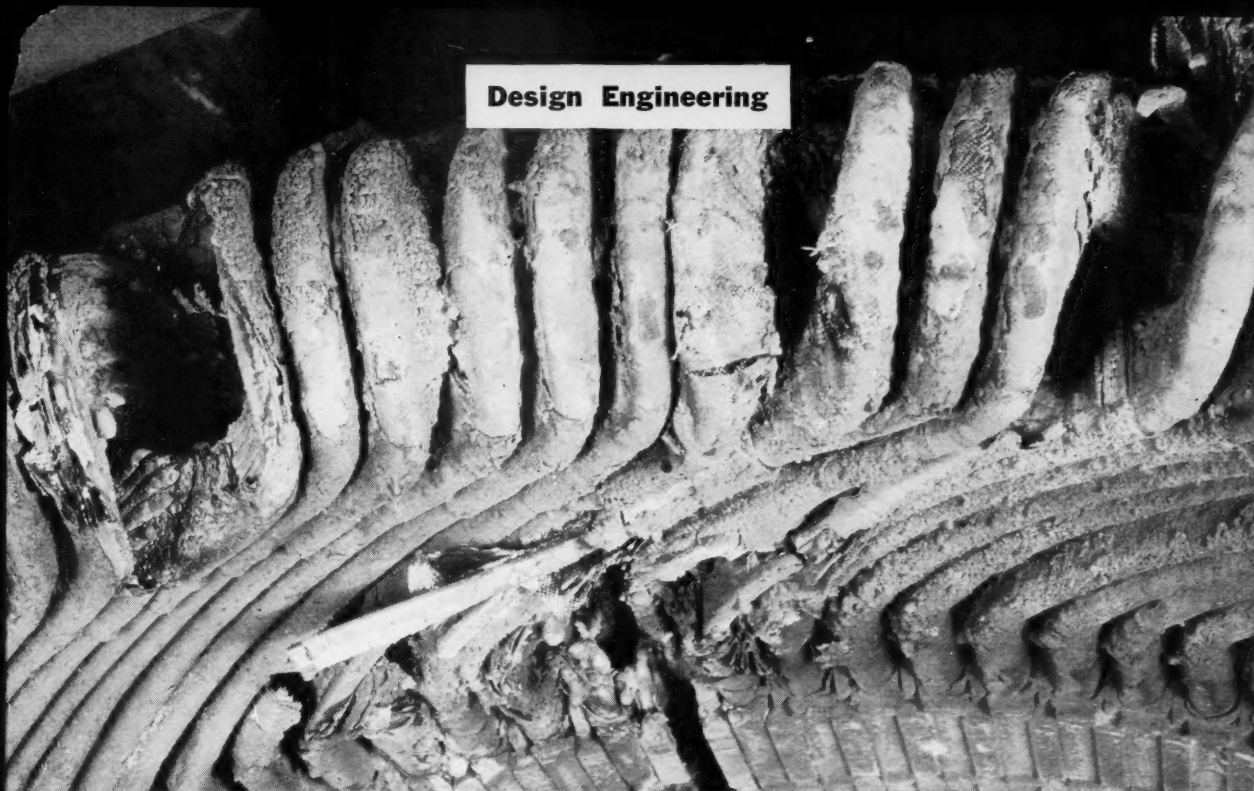
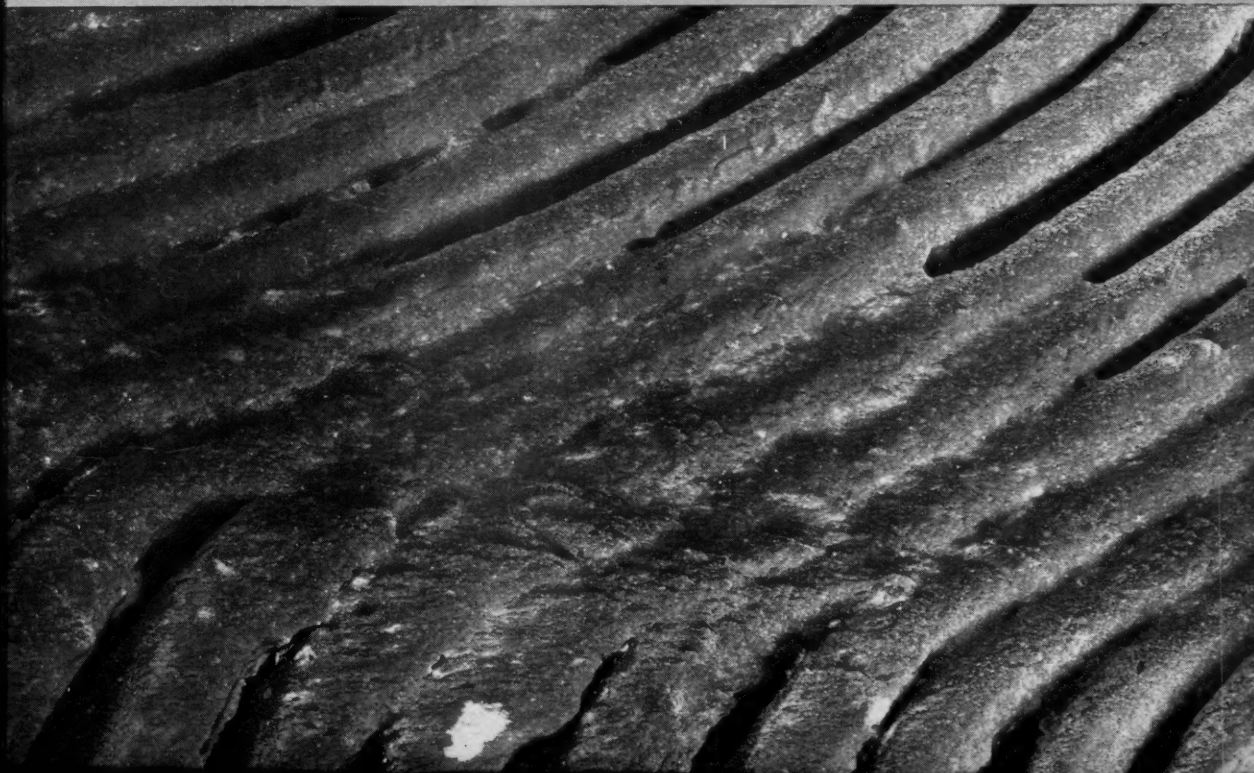


Fig. 1a. This machine, open and unprotected, drove a grinding mill in an alkali plant until dust stopped it.

Unfiltered air can kill motors quickly

Dirt in air is death to electrical motors. Filters lick the problem

Fig. 1b. Alkali and fly-ash clogged cooling air passages resulting in high temperatures and coil failure.



Clogged windings will kill a motor quicker than hard service

It is probable that more electrical motors have been ruined by dirt than by hard service and overload.

Dirt can clog ventilating passages, causing overheating and coil failure. If conductive, it may gather on windings and produce shorts or grounds. If abrasive, it may erode and destroy coil insulation. Bearings, commutators and collector rings can be damaged or destroyed by brush dust or dirt in the cooling air.

The perfect answer to the dirt problem is the totally-enclosed motor so that no outside air reaches the motor interior. This is an expensive solution, however, and one generally reserved for extreme situations.

Air filters that are properly designed (and properly applied) can provide complete protection against these hazards in all but the most extreme circumstances.

Before discussing the application of filters to motors, consider what can happen to a motor without this protection.

The machine in fig 1, open and unprotected, drove a grinding mill in an alkali plant. Notice the fatal accumulation of dust on the windings. A combination of active alkali and fly-ash, it impeded circulation of the cooling air, eroded the coil insulation and attacked the windings chemically. The result can readily be seen: burn-out of several coils, motor shutdown, interrupted production and a sizable repair bill. A comparatively small investment in ventilating air filters could have saved the day.

Figs. 2 and 3 show equally serious motor damage, entirely the result of dirt-laden air.

An effective air filter must have two qualities. It must, of course, efficiently remove atmospheric impurities and it must be slow to clog and thereby impede the flow of air as it accumulates dirt.

The Elliott Ridgway Division, after considerable experimentation with various filter designs, has found the Far-Air high velocity filter to be especially satisfactory. This filter is noteworthy in that the air passes edgewise along the screen, instead of flatwise through the meshes.

The herringbone crimp design (see figs. 4 and 5) provides indirect open channels which permit free passage of the air into deeper filtering media as the near meshes become bridged over with accumulated dirt. ★

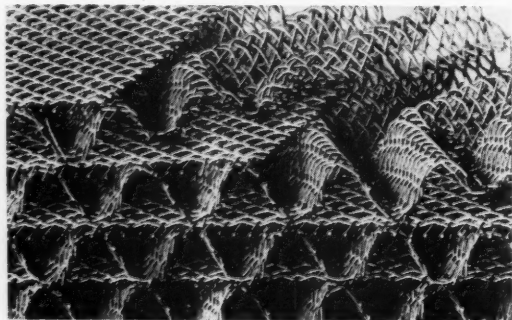


Fig. 4 This is a cross-section of an unused "Far-Air" filter. Note the herringbone tunnels in the open mesh.



Fig. 2. Dirt-laden air has destroyed this rotor fan.

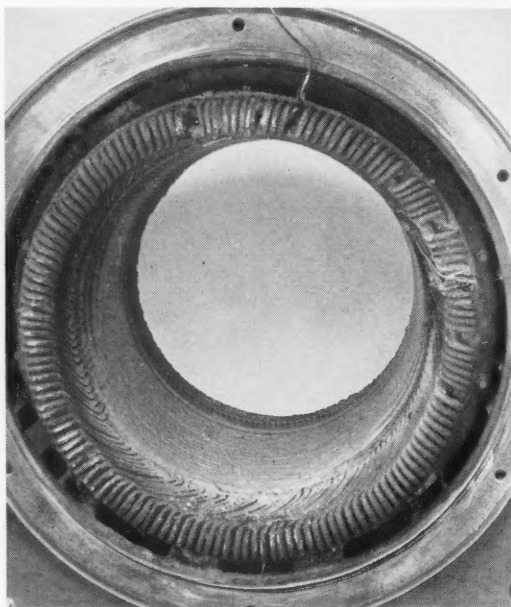


Fig. 3. Another case of coil failure caused by dust.

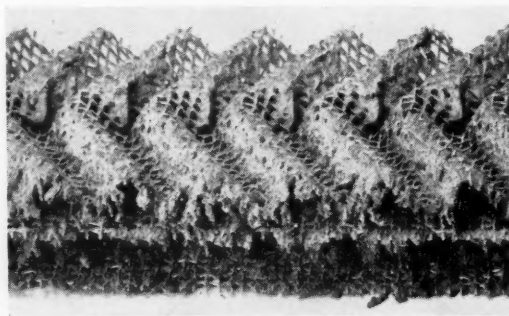


Fig. 5. The used filter with accumulated load of dirt. As near tunnels clog air passes through deeper media.



Final inspection of 12 in. diameter Servofrax window. The large pieces at right are chunks of the raw glass.

Infrared systems are design problems

The aberrations to be corrected are far beyond those in visible optics

By Joseph Jerger Jr.

The engineer who designs optics for infrared systems may often feel that he is attempting to make a fine watch with a Stillson wrench as his only tool. Few materials are available for infrared refracting optics. Transmission varies from one material to the next. The magnitudes of the aberrations that must be corrected are

usually far beyond those encountered in visible optics. In addition, the infrared systems engineer is continually demanding more and more precise performance from his optics.

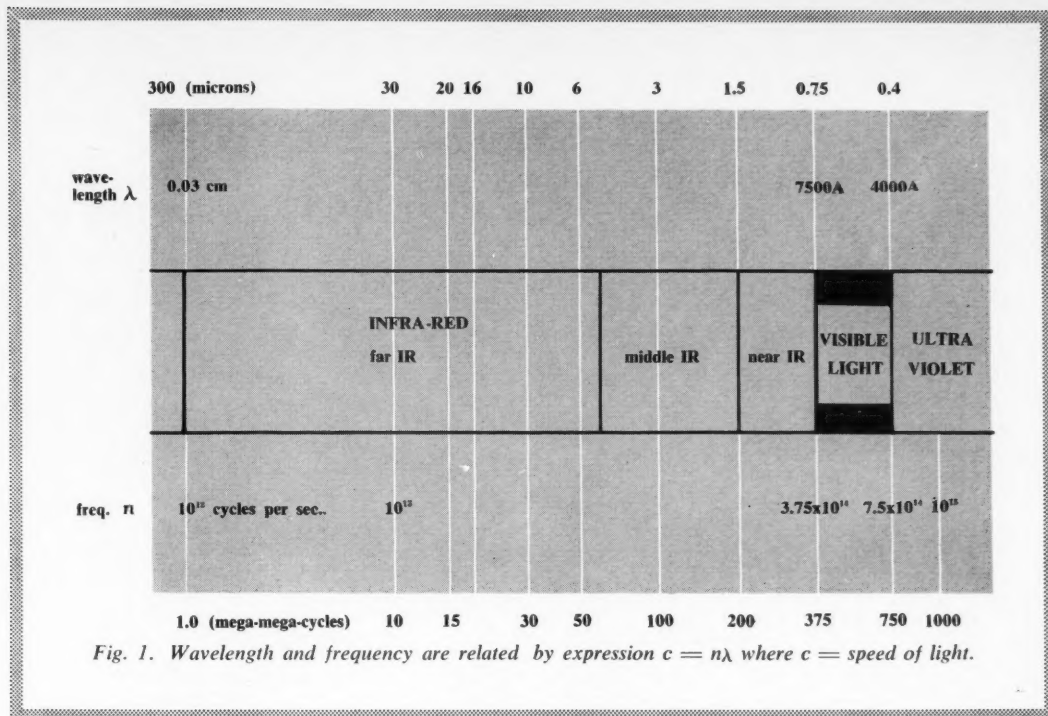
The fundamental difference between designing optical elements for use with visible light and for use with infrared energy is the magnitude and spread of the wavelengths of energy involved. The visible spectrum (See fig. 1) is generally considered to cover the wavelength band from 0.4 to 0.75 microns. (Note that 1 micron = 10^{-6} metre.) That portion of the electromagnetic spectrum which is termed the infrared ranges from 0.75 to 300 microns wavelength. The present practical applications of infrared are generally limited to the spectral region between 0.75 and 16 microns. This limitation simplifies the optical designer's problem to the point where he must consider a wavelength band only about 45 times as wide as that used in visible optics. Other considerations, including detector limitations and atmospheric absorption, may reduce this factor approximately to a 20 to 1 ratio. Even so, it is evident the design problems are multiplied considerably.

These theoretical differences are further complicated by the practical difficulties which present themselves in the over-all design of an infrared system. Some of these are: The optical material selected for any infrared system must transmit to a reasonable extent the wavelengths of energy to which the detector used will

In an article in *Design Engineering*, May 1956, Robert Groves of CGE presented an over-all picture of the infrared field, its present applications and its future possibilities. As indicated, infrared radiation is analogous in its properties and behavior to visible light and this phenomenon is the basis for all types of infrared systems, both military and industrial.

The present article gives a general idea of the problems encountered by the infrared optical designer and the materials available to him for the design of infrared optical elements.

Material	Long Wavelength Transmission Limit (Microns)	Index of Refraction (N _D)	Cold Water Solubility (gms/100ml)	Also Soluble In	Maximum Size	Relative Cost	Description of Material
Servofrax (Arsenic Trisulfide Glass)	12	2.59	0.000	Alkali	Limited only by design considerations	Moderate	As ₂ S ₃ —Homogeneous, red glass. Stable. Non-toxic. Adaptable to all types and sizes of optics. Softening temperature—195° C. Useful for industrial instrumentation. Non-corrosive.
Silver Chloride	23	2.07	0.000	NH ₄ OH Na ₂ S ₂ O ₃ KCN	4" Dia.	High	AgCl—Colorless, cubic crystal. Isotropic. No cleavage. Darkens in sunlight or artificial light with reduced I.R. transmission. Soft and malleable—subject to cold flow. Corrosive to metals.
Potassium Bromide	27	1.55	53.48 0° C	Alcohol Glycerine	7.5" Dia.	Moderate	KBr—Colorless, cubic crystal. Hygroscopic. Soft and easily scratched. Cleaves.
Sodium Chloride	15	1.54	35.7 0° C	Glycerine	7.5" Dia.	Low	NaCl—Colorless, cubic crystal. Hygroscopic. Cleaves. Scratches easily.
Sapphire	5.5	1.77	0.000	—	2.5" Dia.	High	Al ₂ O ₃ —Hexagonal crystal. No cleavage. Does not scratch readily. Excellent mechanical strength. Good thermal properties.
Lithium Fluoride	5	1.39	0.27 18° C	Acid	5" Dia.	Moderate	LiF—Colorless, cubic crystal. Cleaves. Scratches easily.
Calcium Fluoride	9	1.43	0.002 18° C	NH ₄ Salts Solution	6" Dia.	Moderate	CaF ₂ —Colorless, cubic crystal. Cleaves. Scratches easily.
KRS-5	38	2.63	0.02 0° C	HNO ₃ aqua regia	5" Dia.	High	KRS-5—Red, cubic crystal. No cleavage. Strains easily. Difficult to polish. High thermal expansion. Toxic.
Fused Quartz	4	1.43	0.000	HF	Limited only by practical optical homogeneity (6" Dia.)	Moderate	SiO ₂ —Good mechanical and thermal properties. Isotropic.
Silicon	20	3.5	0.000	HF HNO ₃	1.5" Dia.	High	Si—Steel grey, cubic crystal. High melting point. Transmission decreases above 300° C.
Potassium Chloride	21	1.49	34.7 29° C	Alkali Ether Glycerine	7.5" Dia.	Moderate	KCl—Colorless, cubic crystal. Hygroscopic. Cleaves. Scratches easily.
Potassium Iodide	31	1.67	127.5 0° C	Alcohol Ammonia	7.5" Dia.	Moderate	KI—Colorless, cubic crystal. Very hygroscopic. Difficult to polish. Very soft. Cleaves. Scratches easily.
KRS-6	23	2.35	0.1 0° C	—	7.5" Dia.	High	KRS-6—Colorless, cubic crystal. Toxic.
Cesium Bromide	40	1.70	124.3 25° C	Alcohol	1 3/4" Dia.	Moderate	CsBr—Colorless, cubic crystal. Hygroscopic. Soft. Easily scratched.
Glass	3	1.5-1.9	0.000	HF	No limit	Low	Homogeneous. Colorless. Easily cut, ground, polished. Non-toxic.



"He may feel he's trying to make a fine watch with a Stillson wrench"

respond, otherwise the sensitivity of the system is reduced to the point where it becomes unusable or impractical. This, in itself, puts a serious limitation on the selection of materials that may be used. Many materials have properties of selective absorption, due to the fundamental vibrational frequencies of the molecules or due to water absorbed by the material. If these absorption bands fall within the range of sensitivity of the detector, energy is lost in the system and its efficiency is decreased. Many materials which do transmit infrared energy have very high indices of refraction and a lot of energy is lost by surface reflection. While this may be overcome to some extent by using surfaces with reflection-reducing coatings, the gain in transmission is usually appreciable only over a comparatively narrow wavelength band. Also, transmission may be lost at other wavelengths of the spectrum, due to the increase in surface reflection by the coating at these wavelengths.

Some infrared materials are crystals having appreciable birefringence. The orientation of the optical surfaces with respect to the crystal axes must be considered in designing a refracting element.

The peak wavelength of energy emitted by an object depends directly on the temperature of the object. The main purpose of any infrared device is to "see" the objects in its field of view at their true temperature with respect to one another or with respect to some standard radiation plane of reference. To obtain the clearest thermal picture of what the device is "looking at," all the radiation which falls on the detector must come from the target area. If, however, the optics (or the component parts of the system) became heated by energy which they have absorbed, this energy will be reradiated at wavelengths other than that of the inci-

dent radiation. Some of this re-emitted energy may fall within the sensitivity range of the detector and, coming from a source so much closer to the detector than the source of the target radiation, tend to obscure the target or to cause the detection of "ghost" images. This would call for either some method of cooling the system or a complete redesign of the whole device. This phenomenon of reradiation must be kept in mind both by the optical designer and the systems engineer.

As indicated above, the chromatic aberrations encountered in the design of visible optics are of far less magnitude than those associated with infrared optics, because of the smaller wavelength spread of visible light. The glasses available for use in visible optical systems include such a wide range and diversity of optical characteristics that the designer, within broad limits, may name the refractive indices and dispersive properties which he needs for his design and be assured that glasses are available which meet his specifications. Contrast this with the plight of the infrared optical engineer. Not only must he attempt to reduce greater aberrations but he must do so with an extremely limited choice of optical materials. He must take what he can get and design his system accordingly.

For any application other than those in the laboratory, where environment can be controlled, the physical and chemical properties of optical materials are of prime importance. Optical glasses are, for the most part, physically strong, thermally refractory and chemically resistant to corrosion. Infrared optical materials, on the other hand, are generally weak physically, and many of them have a low resistance to high temperature and thermal shock. Many are susceptible also to chemical attack by water, organic solvents, acids and alkalis.

Some of these materials will distort under pressure and lose the figure of their optical surfaces. Therefore, although a material may have the desired infrared transmission, refractive index and dispersive properties, it may be entirely useless for the proposed system, because it cannot stand up to the environmental conditions to which the completed instrument will be subjected. Sodium chloride, for example, is an excellent transmitter of infrared (see fig. 2) but is hardly suitable for use as a lens that has to be exposed to a humid atmosphere.

Finally, one who wishes to propose materials for use in infrared optical systems must not be misled by the apparently high transmission of thin sections of a material. The effect of increased thickness on transmission must be determined, since this will be the limiting factor on the geometry of satisfactory optical elements made from any material.

Infrared optical systems fall into three principal categories: reflective, refractive and combinations of the two. The theoretical considerations involved in all these systems are directly analogous to those of visible optics.

Reflective systems are useful at all wavelengths and there is no loss of transmitted energy due to absorption by the optical elements. Reflecting surfaces for the infrared have high efficiency and most of the energy entering the system is available to generate the output signal. Part of the energy is always lost to some extent in a reflecting system, however, because the detector (or a secondary reflector) must be mounted in the centre of the beam. Mounting and alignment problems are generally more difficult in a reflecting system than in a refracting system. Telescope makers have long recognized the fact that, due to a number of contributing factors, the effect of changes in the temperature on a reflecting system (or of variations of temperature throughout the system) are much more critical than on a refracting system.

Although there is no masking of the centre of the energy beam in a refracting system, a lot of the available energy is frequently lost by absorption in the optical elements and by reflection from the optical surfaces. It is possible to obtain much wider fields of view with refracting systems because of the greater possibility of correction for off-axis imagery. This is true even when compared with a reflective-refractive design such as a Schmidt system, which allows the increase of angular field from, say, 1 deg to 3 deg, without sacrificing resolution. Refractive systems are sometimes designed for as much as 30 deg on either side of the axis using a single detector.

In selecting a material for any infrared application the following factors must be taken into consideration. **First:** what the infrared transmission is, the long and short wavelength limits, how it varies with thickness and what possibility exists of getting increased transmission by using an antireflection coating. **Second:** the optical properties must be determined—the index of refraction, the dispersion and whether or not the material is birefringent. **Third:** how are the chemical and physical properties of the material suited to the proposed application—the physical strength, temperature limitations, thermal shock resistance, resistance to atmospheric corrosion and solubility in water and other solvents? **Fourth:** are the necessary sizes and shapes available and is the cost of the material economical for the system in which it is to be used? Since the selection is limited, some compromise will probably have to be made in one or more of the listed characteristics and the over-all

(Continued on page 74)

Some of the infrared optical materials:

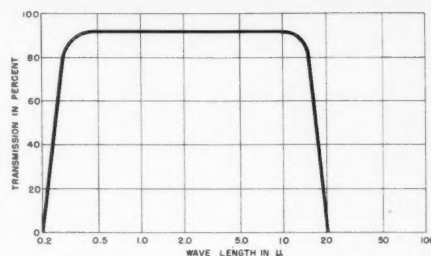


Fig. 2. Sodium chloride. Thickness 10mm.

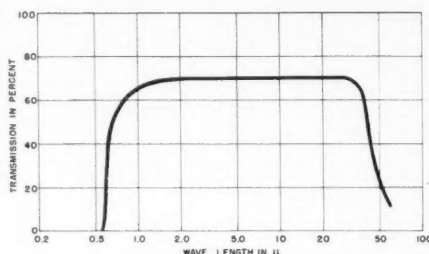


Fig. 3. Thallium bromide iodide. Thickness 2mm.

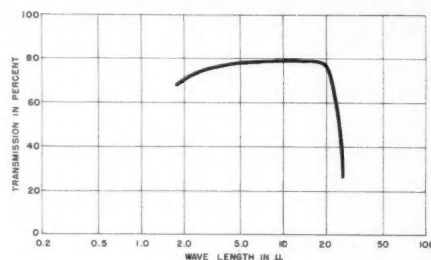


Fig. 4. Silver chloride. Thickness 10mm.

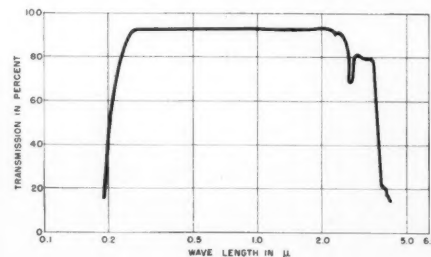


Fig. 5. Fused silica. Thickness 10mm.

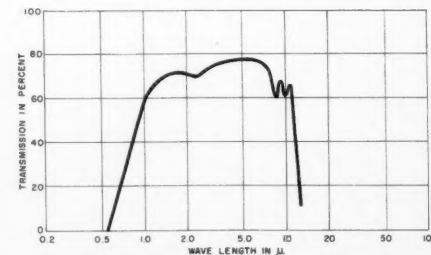
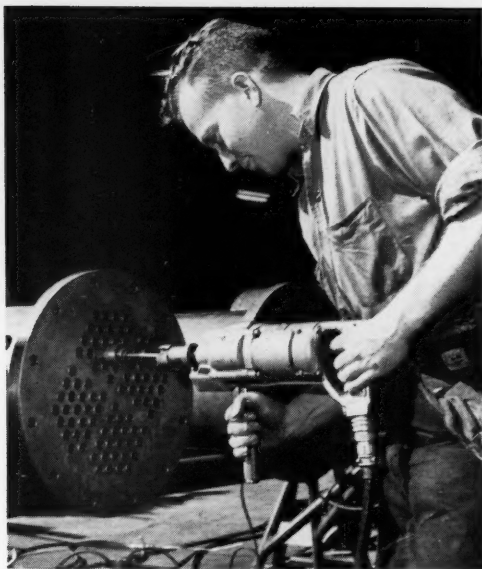


Fig. 6. Servofrax (trademark). Thickness 2mm.



Finned tube ends are expanded in pressure vessels.

Tubes grow fins to boost heat transfer

The rotary extrusion of fins on a tube more than doubles outside area

By F. S. Brown

The use of fins to increase surface area and thus greatly increase the heat transfer effectiveness of metal tubing is well established. The development of a low finned tube has permitted the advantages of extended surface to be applied to shell and tube exchangers. This tubing (produced by a rotary extrusion process) was developed by Wolverine Tube and is manufactured in Canada by the Unifin Tube Company.

The result of this cold roll-forming process is a finned tube having integral helical fins which are formed out of the tube wall without removing any metal. The particular characteristic of this tube which makes it ideal for shell and tube heat exchangers is that the base tube is "sunk" during the finning operation. The outside diameter over the fins is thus slightly less than the outside diameter of the base tube. By omitting the fins at both ends of the tube, it is suitable for rolling into tube sheets and the finned section will pass easily through both tube sheets and baffles. The construction of the tube is illustrated. The fins on the tube are extruded to a height of approximately 1/16 in. —and spaced so that either 16 or 19 finned tubes can be produced in most of the standard condenser tube metals.

The resulting tube has approximately 2½ times the outside surface of a plain tube of the same outside diameter. The ratio of outside surface to inside surface is about 3.5 to 1.

To appreciate how the extra surface can be used to advantage, one must appreciate the mechanics of heat transfer through a thin-walled tube. Heat is transferred through a tube in accordance with the formula:

$$\begin{aligned} \text{Total heat transferred} &= \text{Coefficient} \times \text{Outside area} \times \text{Temperature difference} \\ H &= U \times A \times \Delta T \end{aligned}$$

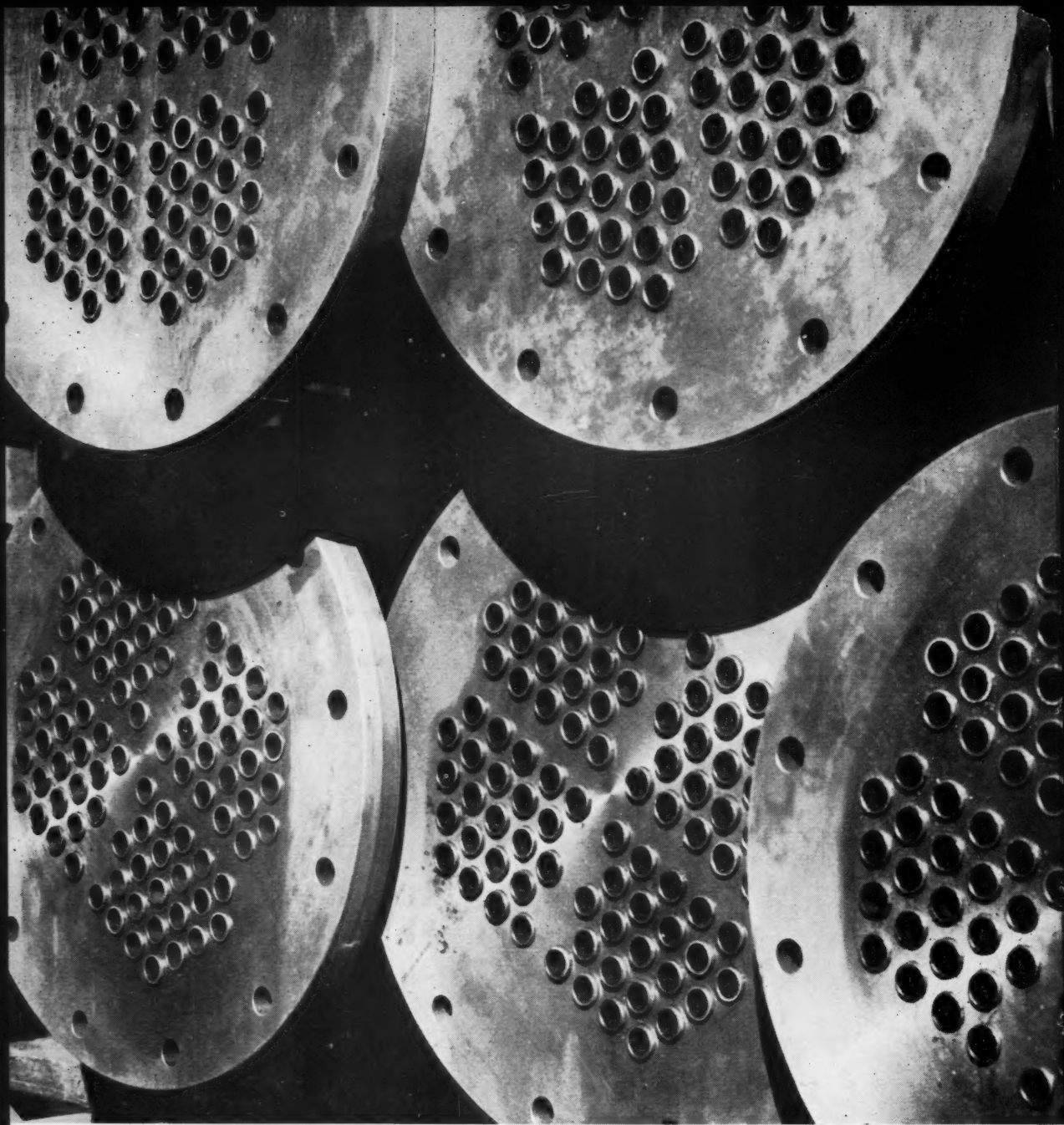
The use of a finned tube directly affects H by increasing the value of A by 250%. It also affects the value of U , the over-all coefficient of heat transfer. Values of U are determined by the following formula:

$$\begin{aligned} \text{Over-all coefficient} &= \frac{1}{\frac{1}{\text{Inside coefficient}} + \frac{\text{Outside coefficient}}{\text{area}} + \frac{\text{Metal resistance}}{\text{area}} + \frac{\text{Inside fouling}}{\text{area}}} \\ &+ \frac{\text{Inside coefficient}}{\text{area}} \end{aligned}$$

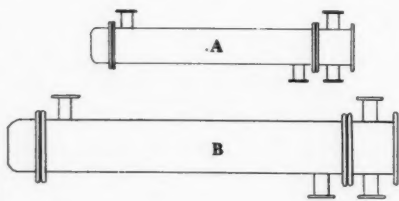
Since this formula relates to the previous equation, all factors depend on the outside surface. Each factor in the above formula may be considered as a resistance to heat flow.

The effect of a finned tube is two-fold. First, the fact that the tips of the fins are not at the same temperature as the base tube creates an inefficiency which must be accounted for when calculating the values of the outside coefficient. Secondly, in relating inside resistance to the outside surface their values in the formula are increased by about 3½ times.

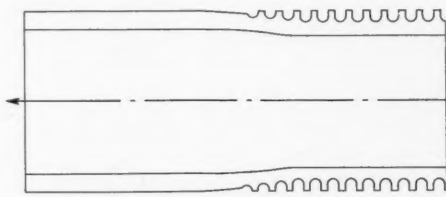
What does all this mean in terms of application? In considering the economic use of low finned tubing in a heat exchanger, one fundamental condition must exist. **One of the fluids must have a lower film coefficient of heat transfer than the other under comparable conditions of flow.** The fluid with the lower coefficient should be routed through the shell side, to flow outside the finned tubes. Since the same amount of heat must pass through any hypothetical section of tube, the low coefficient (combined with the large sur-



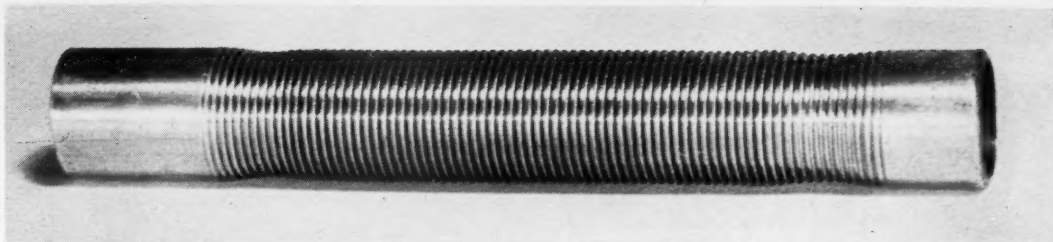
These pressure vessels are for an air-conditioning system. Shells are brass, tubes and sheets cupro-nickel.



The use of Unifin means smaller units.



A cross section through a partly finned tube.



The Unifin tube has approximately 2½ times the outside surface of a plain tube of the same outside diameter.

face of the finned side) more closely balances the high inside coefficient and the small area of the inside of the tube.

The degree of economic advantage depends primarily on the ratio of inside and outside coefficients. Other factors do, however, enter into the consideration. A high inside fouling factor works to the disadvantage of finned tube, since its net effect is to reduce the inside rate tube and reduces the advantage of the finned tube.

Since the ratio of outside-to-inside-area of low finned tubes is fixed, the designer must make sure that the coefficient ratio is at an optimum value. The inside coefficient is raised by increasing the inside fluid velocity to as high a point as allowable pressure drop and tube metal will permit.

Fortunately the majority of services encountered meet the fundamental requirements for economic utilization of finned tube. All services may be classified in three broad categories: condensation; heating or cooling; and vaporizing. In all three categories the majority of services are such that the shell side fluid has a lower heat transfer coefficient than the tube side fluid. The degree of economy varies of course from service to service and depends on how skilfully the designer takes advantage of finned tube.

When the subject of finned tube in commercial service is considered, the effect of fouling on the finned surface is of prime concern. Extensive study of pilot plants and commercial units proves conclusively that the fouling of finned tubes is comparable to plain tube.

The valleys between the fins do not fill up with fouling material; rather does the fouling deposit itself evenly on the surface of tube and fin, thereby preserving the effective surface contour.

Since low finned tube behaves comparably with plain tube under fouling conditions, it is possible to use the same fouling factors in design. These factors are determined by experience and from tabulations (such as in the standards of the Tubular Exchanger Manufacturers Association). To summarize, the use of finned tube need not be restricted to clean services. Recent field reports indicate that these tubes actually give better service under fouling conditions than does plain tube.

The potential utilization of low finned tube is twofold. It can be used in new equipment and it can be used in existing equipment by retubing.

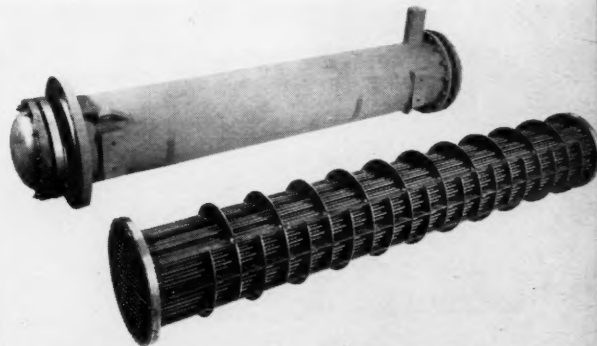
In any operating unit, the problem of increasing its capacity must eventually be faced. Often, heat exchangers are the limiting factor. When a heat exchanger has reached its capacity, sometimes merely by retubing with finned tube its capacity can be increased by as much as 100%, depending, of course, on the factors outlined above. The saving, by buying tubing (instead of a completely new exchanger) is significant

and should be considered in all cases before the purchase of new equipment. Remember also that retubing does not disturb the existing layout in any way; expensive and inconvenient alterations are thus avoided.

The basis for the use of low finned tube in new heat exchangers is that it significantly reduces the material and labor content and thereby reduces the cost of the units. Savings of 20% or more are not uncommon. Low finned tube (although more expensive than plain condenser tube on a lineal foot basis) reduces tube costs, because the reduction in total tube requirements normally more than compensates for the extra cost. Fewer tubes allow the use of smaller shells, heads, baffles and so on and thus effect a real saving in material costs. Fewer tubes mean fewer holes to drill, fewer rolling-in operations and lower fabrication costs. To transfer a given heat load, much less weight of tube metal is required when low finned tube is used. The more expensive the alloy, the greater the saving. This consideration is also important when alloy metals are in short supply, for a given quantity of metal in the form of finned tube transfers much greater heat loads.

There are also auxiliary savings involved. Lighter units require less structural support, take less space and are more easily handled. Finally, maintenance costs are low and fewer tubes mean less cleaning and off time.

These tubes have been (and are being) widely used by Canadian processing industries. In one Canadian refinery, an installation was made recently involving 91,500 lineal feet of low finned tubing (approximately 40,700 sq ft of surface.) This tubing was used in such services as light naphtha crude fractionator overhead condenser, debutanizer overhead condenser, compressor aftercooler and also for a top pump around cooler. ★



Lo-Fin tubes in a heat exchanger for Ontario Hydro.

Balancing

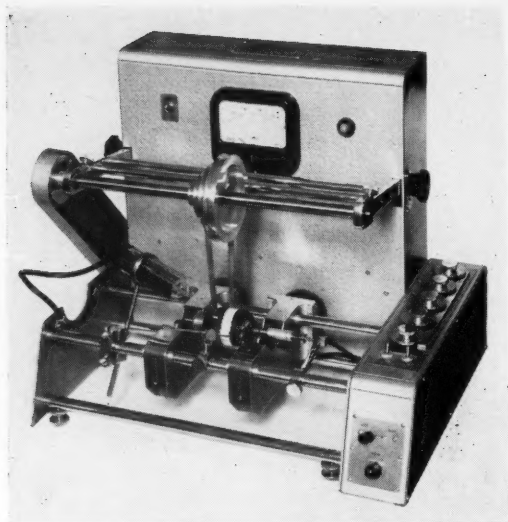


Fig. 1. A portable unit for mass production balancing.

High speeds need dynamic balancing

The types of unbalance may occur separately, but are usually together

By S. A. Rybb

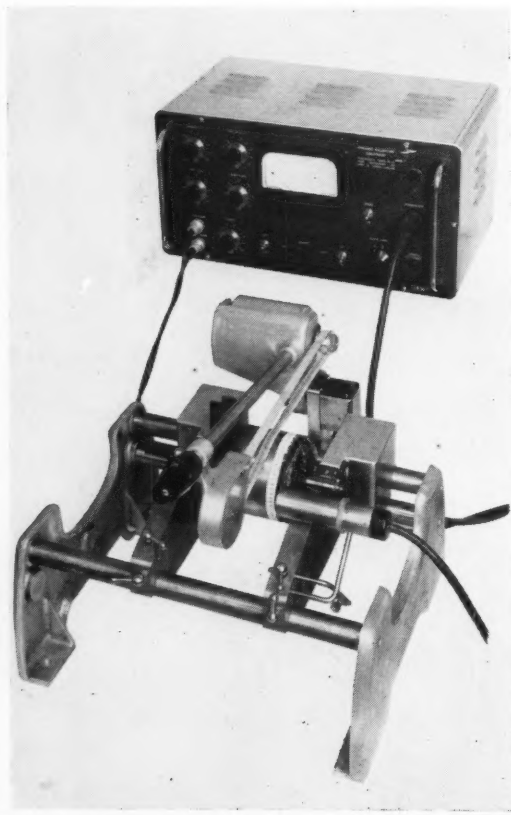


Fig. 2. Dynamic balancing equipment—horizontal jig.

One consequence of the high speed of rotation of modern machinery is the corresponding demand for higher accuracy in dynamic balancing.

Unbalance, which is usually due to the fact that no body is perfectly homogeneous (or the fact that machining operations can only be performed within certain dimensional tolerances) gives rise to vibration of the bearings and surrounding parts, thereby subjecting them to undesirably high strains.

There are two types of unbalance. These may occur separately, but usually take place together. The first is static unbalance, which is caused by a movement of the centre of gravity of the body from its geometrical centre. There is thus a tendency for the body to rotate about its centre of gravity (c.g.) and not about its geometrical centre. The other is dynamic unbalance which gives rise to a tendency for the body to rotate about an axis not coincident with its natural axis of rotation. In both cases, the unbalanced forces produced are proportional to the square of the angular velocity, a fact which emphasizes the need for correct balancing in machines operating at high speed.

Consider a circular lamina (fig. 3) rotating at an angular velocity ω (radians per second) about an axis perpendicular to it and passing through its geometrical centre. Assuming that the weight is uniformly distributed, the c.g. coincides with the geometrical centre O and it will be perfectly balanced.

If an out-of-balance weight of mass m be placed at the point A , the c.g. of the lamina will move from O to O_1 , the system will become unbalanced and a centrifugal force (proportional to the out-of-balance mass and the square of the angular speed) will act at this point A .

The balance of such a flat, thin disc is relatively easy. All that is necessary is to add a similar mass m , at the point B located diametrically opposite A. Assuming that the disc is so thin that it lies in one plane, the forces and moments can be shown to be in perfect equilibrium.

With such a workpiece it is therefore possible to use a static balancing method (as shown) to obtain perfect balance. There is, of course, no such thing in practice as a disc of negligible thickness, but flywheels, grinding wheels and the like can usually be brought to a satisfactory state of balance in this manner. For nonplanar bodies the situation is much more difficult.

Now consider a shaft (fig. 4) made of perfectly homogeneous material, rotating about an axis XX at an angular speed ω . Since the material is homogeneous, there are no out-of-balance forces acting. The rotor's c.g. coincides with its geometrical centre along the axis XX and the system is in perfect equilibrium.

If a mass m , be attached at point A, the c.g. will move to O_1 and cause static unbalance. A mass m_1 , attached in a plane farther along the body (at point B), will bring the c.g. back to the point O, thus restoring the static balance. There will, however, be a small twisting moment tending to distort the body even when it is stationary. When the shaft starts to rotate, this moment will be overshadowed by the large centrifugal forces generated, and the body will tend to rotate about axis YY instead of its natural axis XX.

The forces acting on the body (and indicated by the arrows) are, in fact, instantaneous ones whose direction of action changes as the body revolves. The forces applied to the bearings are thus cyclical and in phase with the rotation. As the angular velocity of the body varies, so will the periodicity of the forces applied to the bearings. This variation of periodicity is particularly dangerous, since it may violently excite any components that have a natural frequency within the range covered.

How to overcome this

To restore the equilibrium, it is necessary to apply a couple at a diametrically opposite position and of such magnitude that the original out-of-balance couple is counterbalanced. In practice, this would amount to placing the counterbalance weights along the appropriate plane while the body is in motion. In the majority of cases, however, this is not a practical proposition, because the masses may occur in any plane along the shaft. Equilibrium is therefore achieved by introducing the counterbalance weights at two convenient cross sections.

It will be shown that balancing can be carried out in any two arbitrarily selected planes perpendicular to the axis of rotation. For convenience, and also to make correction planes as far apart as possible (so that the minimum correction weight is necessary) they are usually the end planes of the rotor.

Consider the shaft of fig. 5 rotating about an axis XX. Let the resultant of all forces due to static lack of balance be P, acting at the point C as shown.

The force P can be resolved into forces P_a and P_b is equal to the force P, that is, $P = P_a + P_b$.

2. The sum of the moments of P_a and P_b about any point is equal to the moment of P about the same point. Thus, taking moments about point C,

$$P_a \times a = P_b \times b.$$

By moments about the R.H. end it is clear that:

$$P_a = \frac{b}{l} P \text{ and } P_b = \frac{a}{l} P$$

Let S be the resultant moment due to lack of dynamic balance.

Any couple can be replaced by another one of the same moment, acting in the same direction. Thus, the couple S can be replaced by a couple S_a , where $S_a = S_b$, such that $S_a \times l = S \times r$.

(Note that S_a is parallel to S at D and S_b is parallel to S at E.)

In this way, we obtain two systems of forces acting on each end plane, and these two can be further simplified by the vectorial addition of forces in each plane, producing R_a (acting in end plane A) and a corresponding force R_b (acting in the end plane B) as shown in fig. 3. If forces equal in magnitude and opposite in direction to R_a and R_b can be applied in their respective planes, balance can be achieved.

Electronic balancing machines

It is evident that the equilibrium of the forces and couples about the central axis can readily be achieved by static balancing. These same corrections must, however, balance out the other out-of-balance couple acting in a longitudinal direction to the rotating member. This second condition of balance would appear to be a difficult and lengthy operation. However, the development of suitable electronic circuits has now rendered this a routine operation, to be carried out easily by unskilled operators in a very short time.

An electronic balancing machine consists basically of three main parts:

1. Pickup unit, where mechanical vibrations due to unbalanced forces are converted into an electrical signal.
2. Control circuit, where the correction planes are resolved.
3. Amplifier and detector unit, where the electrical signal is magnified and fed into indicators to denote the magnitude and the angular position of the unbalance.

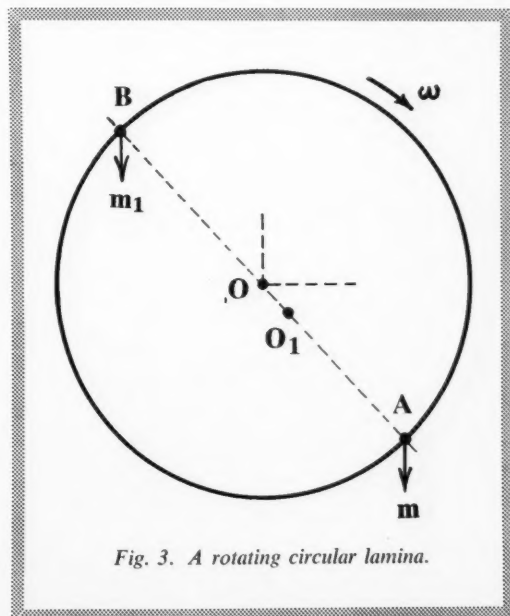


Fig. 3. A rotating circular lamina.

Basically, there are three parts to the electronic balancing machine

One such device, currently on the market, is shown in fig. 1. It is a small portable unit designed for the mass production balancing of small rotors, such as armatures of fractional hp motors (used for refrigerators, fans, vacuum cleaners and polishers) and small rotating parts of servomechanisms and so forth.

In this instrument, two coils are free to move within the field of two powerful permanent magnets. The coils are connected by means of connecting rods to two light cradles and are free to move in one plane only. The workpiece is supported horizontally in V mountings carried on the cradles. The position of the cradles can be adjusted to suit the length of the body. A belt drive from an electric motor, through a set of pulleys which can be selected to give a desired speed, is used to rotate the workpiece. With the rotor thus mounted and the motor running, the unbalance in the workpiece will cause vibration of the supporting cradles, the amplitude of the vibration being proportional to the amount of unbalance. The movement of the cradles produces the simultaneous movement of the coils within the magnetic field. For a given angular speed, the emf induced in the coils is directly proportional to the amplitude of mechanical vibration and hence to the amount of unbalance.

The electrical signal thus produced is then fed into a

mixing circuit, the controls of which enable the operator to select the desired correction plane. From the control circuit the signal is fed into an amplifier unit and output meter, which are so arranged that very minute vibrations will give reliable readings on the meter.

A filter network is included in the instrument. The purpose of this filter is to pass only those vibrations of the workpiece which occur once per revolution and to eliminate any spurious vibrations.

Control switches are provided adjacent to the workpiece. As correction for unbalance is normally made in two transverse planes, one switch selects the plane (left- or right-hand side) and another one selects one or two alternative ranges of meter sensitivity. Unbalance readings in one plane are not affected by unbalance in the other plane.

The angular position of the unbalance is obtained by a stroboscopic lamp. The lamp is caused to flash every time the voltage in the pickup coils changes in polarity. From the flashing of this lamp, one of the numbered graduations placed on the workpiece can be read very easily, as the number will appear to stand still. This numbered graduation indicates directly the angular location of the unbalance correction. A control switch enables the operator to select either Heavy or Light position. When the balancing method employed is to remove the material (as by drilling), Heavy position is used. If, on the other hand, corrections are applied by adding material (by inserting strips of brass or screws), Light position is selected.

Sensitivity obtained

The instrument has considerable accuracy due to the lightness of the cradles, which are free to vibrate without damping the vibrations of small amplitude. Furthermore, due to the amplifier used, the meter is extremely sensitive and gives an indication of approximately 5% of the full-scale deflection for a displacement as small as 50 micro-inches peak to peak. The corresponding unbalance (oz.-in.) is given by the formula:

$$\text{Weight of rotor (oz.)} = \frac{40,000}{\text{Deflection (in.)}}$$

The meter is calibrated arbitrarily from 0 to 100 so that users can calibrate it in terms of their own balancing methods.

The dynamic balance obtained in this manner makes corrections so that the sum of centrifugal or centripetal forces is zero, that is, $\sum mrw^2 = 0$, where m is the mass of the element, r its radius of operation and w the angular velocity. Since it was assumed that the body was fixed, w will be constant for all its sections. Thus, $w^2 \sum mr = 0$ or $\sum mr = 0$, which is the condition for static balance. A dynamically balanced workpiece is therefore also in a state of static balance, but as already shown, the reverse is not necessarily true.

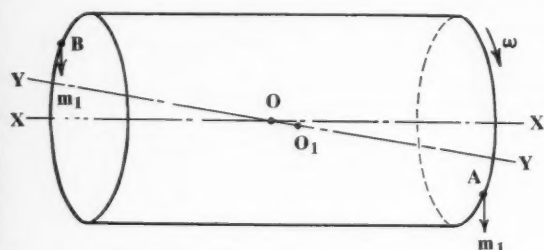


Fig. 4. A shaft of perfectly homogeneous material.

Our author considers these shafts in the text.

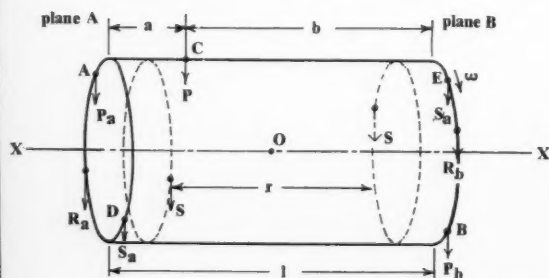


Fig. 5. "Consider a shaft rotating about axis XX."



Fig. 6. The armatures from the motors of electric polishers undergo the balancing operation in the factory.

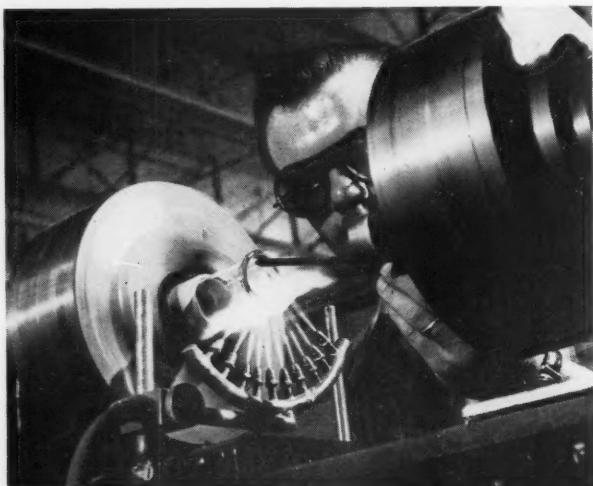
"There is usually unbalance because no body is perfectly homogeneous"

Despite its efficiency and sensitivity, the apparatus described above is limited in use by its capacity. There are a number of workpieces which, due to their awkward shape or size, cannot be handled by this particular type of machine. In addition, a fair proportion of motors, in present-day applications, are used with the rotor shaft mounted in the vertical position and it is very often advisable that they should be balanced under conditions simulating those of their applications. To meet the demand for a machine capable of fulfilling those requirements, the same manufacturer designed a modified version of the apparatus described above. It is virtually a unit construction version of the previous model. The amplifier and indicator part of the equipment, together with the control circuit, are built as a single unit, whereas the pickup section is an entirely separate part. It has neither suspension nor drive, the provision of these being left to the user so that he may satisfy his own individual requirements in this direction. Apart from this, the operation of the two is the same.

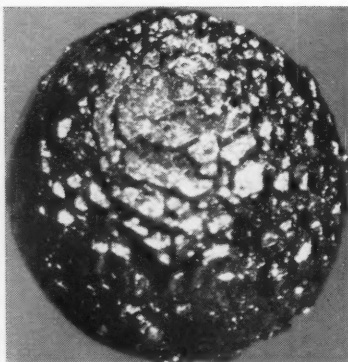
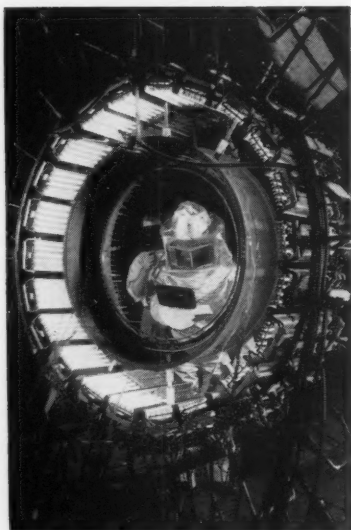
For horizontal balancing, electromagnetic pickups are used, set to accommodate virtually any shape or size of small armature. For vertical balancing, a special jig fixture is supplied, which employs a single crystal pickup. This pickup acts in a similar fashion to the electromagnetic unit, that is, it generates voltage proportional to the amplitude of the vibrations, provided the speed is constant.

A great advantage of this type of balancing equipment is that all the control units are entirely separate from the drive and from the suspension of the component being balanced. The control units may therefore be mounted separately in as rigid a manner as may be required. In addition, being separately supported, they are entirely isolated from the vibrations caused by the balancing operation. This is particularly important when large bodies are balanced, since the sensitivity of the equipment can be increased considerably without being affected by the magnitude of the out-of-balance of the workpiece under test. ★

Design news in pictures

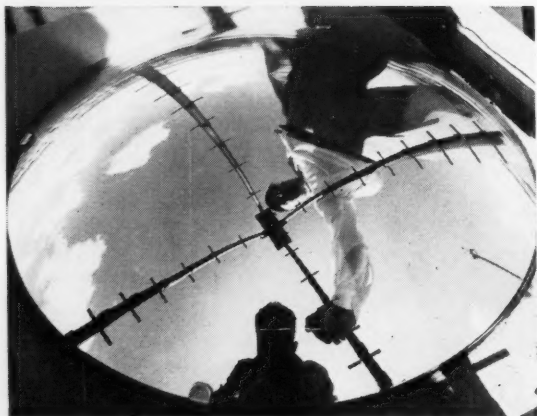


A glass lathe operator flares out the end of a piece of glass tubing before sealing it into a metal tube in the chuck at right. Glass to metal sealing is an essential operation in the manufacture of magnetrons and other electronic tubes. (200)



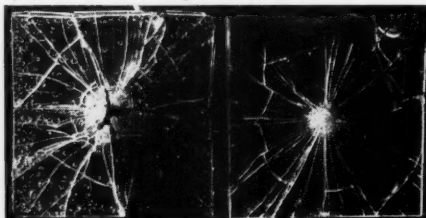
*Extreme left:
Two engineers study the triple-torture effects of simultaneously heating and cooling a metal ring which simulates an aircraft's fuselage under stress. (201)*

*Left:
A spherical single crystal of Zn_3As_2 showing growth in preferred directions which correspond to specific planes in the crystal. Magnification 26X. (From the IBM Journal of Research and Development. (202))*



*Left:
Photographer and researcher are reflected in the 15-in. convex mirror of an "all-sky" camera set up at the University of Saskatchewan. Under study is the Aurora Borealis. (203)*

*Below:
After a few minutes at 375 deg F most safety glass interlayers soften and ooze out of the panel edges (left). The new Silastic layer can remain clear after hours at 375 deg F. (204)*



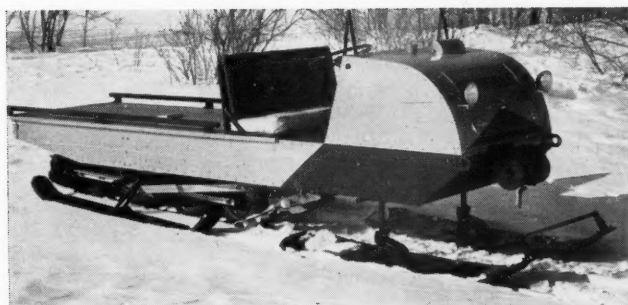
Some modern designs making news today



Left: Not a micrograph but an air view of Toronto. No prize for the right answer but can Toronto readers identify the area? (205)



A new pyrophoric magnetic material from Westinghouse shows off for the camera. (206)



Above: The go-anywhere Unimog by Mercedes-Benz is a diesel powered basic unit which has attachments available for hundreds of uses in mining, industry and farming. (208)



Left: The Skimobile is being tested for military use in the far north. Able to travel over any depth of snow or over muskeg, it has a Volkswagen engine as powerplant. (207)

America's first supersonic bomber, the B-58 Hustler, stands a-tiptoe on its stilt-like landing gear. The Hustler carries a 3-man crew. (209)

These arc welds are sound and clean

The submerged arc method gives low shrink, easy setup and clean welds

By S. Gyurik

An investigation was recently made of the different welding processes suitable for the fabrication of landing gears and large tubular components, using 4340 steel with a heat treatment range of 180,000 to 200,000 psi. Due consideration was given to the several factors involved such as: adaptability and flexibility of the process; expected development cost; tooling; setup time; and influence of the process on the design.

The conclusion: that submerged-arc welding is a very satisfactory answer to the problem.

Submerged-arc welding is a method in which the heat required to fuse the metal is generated by an electric current passing between the welding wire and the workpiece. The tip of the welding wire and the workpiece are not in contact and both are covered by a layer of granulated mineral material (flux). A relative motion at a constant speed exists between the wire and the work.

The terrific heat evolved by the passage of the electric current through the welding zone melts the end of the wire and the adjacent edges of the workpieces, creating a puddle of molten metal. This puddle is in a highly liquid and turbulent state and consequently any slag or gas bubbles are quickly swept to the surface. The granulated material completely shields the welding zone from contact with the atmosphere and a small amount of this material fuses. This fused portion serves several functions: it provides a medium through which the electric current passes between rod and work; it completely blankets the top surface of the weld, preventing atmospheric gases from contaminating the metal; it dissolves (and thus elimin-

ates) impurities that separate themselves from the molten steel and float to its surface and so can be the vehicle for adding certain alloying elements. The combination of all these factors results in an unusually sound, clean, homogeneous weld.

Since, in this case, the submerged arc process was meant to be limited strictly to circumferential welding, a welding lathe with a maximum permissible swing of 7 ft was built, incorporating a variable speed drive, in order to obtain the proper welding speed. The other factors involved are: the welding current and voltage supplied by a constant potential unit; the width and depth of the layer of granulated material coming from a hopper through an adjustable cock; several mechanical adjustments of the wire in relation to the workpiece; the chemical composition of the welding wire and its ability to take the heat-treatment given to the welded assembly; the several heat-treatment operations (such as preheating, postheating and stress relieving) necessary for the attainment of a 100% sound weld.

The results have been extremely gratifying for the following reasons:—

1. Negligible shrinkage. This allows the different components to be at a very advanced stage of machining and cuts final machining time. In this respect, submerged-arc welding shows a great advantage over flash welding and Uniweld methods.
2. Very easy setup, similar to the setup of a landing gear on a large lathe. Submerged-arc welding again shows a marked advantage over the other processes.
3. Extremely sound welds, free of inclusions, gas pockets and slag and showing a very smooth surface.
4. Excellent weld-to-parent metal strength ratio after heat treatment. Tensile tests made on typical test samples have shown a minimum ratio of 94%. ★



Welding lathe with maximum swing of 7 ft and variable speed drive was built. Finished workpiece is at right.



Engineer checks rain water pressure and precipitation in controlled chamber used for checking equipment.

Humidity has a big role in industry

Controlled humidity has ceased to be a luxury. It is now a necessity

By E. L. Campbell

Humidity Measurements. What Are They?

Relative humidity (RH) is the ratio of the amount of water vapor in a given amount of air, expressed as a percentage of the maximum amount of water vapor the air could hold at the same temperature and pressure.

Dewpoint is the lowest temperature to which the air can be reduced without condensation of some water vapor.

Moisture content is the actual weight of the water vapor in the atmosphere, generally expressed in grains of moisture per pound of air.

Vapor pressure is the partial pressure exerted by the water vapor in the atmosphere, generally expressed in inches of mercury.

Of the four, relative humidity is by far the most common way of measuring water-in-air.

For most industrial plants the measurement and control of humidity (or the moisture content of air) is no longer a luxury, but a necessity. In countless processes, product quality and production depend upon such control.

It's not just a matter of comfort, although comfort is important in air-conditioning. The moisture in air affects product quality and process efficiency in textile, paper, food, lumber, printing, natural and manufactured gas, test cell, tobacco drying, leather, metal processing and many other industries.

But the "water-in-air" relationships are varied, as are the methods of measurement and the methods of control. Each installation must be tailored to the individual plant or process, and, since no two installations are ever exactly alike, literally hundreds of problems arise. But the proper selection of instruments and controls, plus a good practical and theoretical knowledge of the "water-in-air" relationships, should solve them.

Humidity continued

Temperature has a lot to do with relative humidity. Keep the same amount of moisture in the air, change the temperature and you get a different humidity.

For instance, assume that you have a sealed chamber. The temperature within the chamber is 70 F; relative humidity 77%. Now turn on the heaters and increase the temperature to 80 F. The relative humidity drops from 77 to 44%.

If, on the other hand, you turn on a refrigeration unit instead and reduce the temperature to 65 F, the relative humidity increases to 100%. Since the atmosphere is holding all the moisture it can, moisture condenses. At 100% relative humidity you meet another measurement — dewpoint.

The textile industry pioneered in industrial humidity control. They found that variations in relative humidity in weave rooms wrought havoc with production. The addition of faster and more efficient machinery made things worse.

All natural and most synthetic fibres are hygroscopic; that is, they readily absorb (or give up) moisture. If the fibres are too dry, they become brittle and hard to manage in weaving. They break, tend to break the needles, pick up static electricity and create a fire hazard.

If the fibres are too moist, they may mildew and may stick together or to the machinery during processing. Only by controlling relative humidity can the mills keep fibres strong and flexible and production flowing smoothly.

Printers have found that control of relative humidity is important for another reason: expansion and shrinkage. Paper, too, is hygroscopic. It expands as its moisture content increases; contracts as it decreases.

Since the size of the paper is only as stable as the relative humidity of the air surrounding it, changes in that humidity have serious effects.

If paper is not kept at a constant humidity, the expansion and contraction will cause it to buckle or curl on the presses. In multicolor work, dimensional changes will, in addition, spoil the alignment of colors on the page.

There are many ways in which relative humidity control is used, and there are many different types of

instrument (and sensing element) to do the measuring and controlling.

The primary standard for measuring atmospheric moisture is the **gravimetric method**. It consists of weighing the quantity of water removed when a carefully measured volume of air is passed through an adsorbent (such as silica gel). The gain in weight of the adsorbent is the moisture content of the air sample. This method is impractical for industrial purposes, but instruments that will do the job accurately are available.

Humidity devices actuated by changes in hygroscopic material (such as human hair), and which read directly in percent relative humidity, are called hygrometers.

Hair is hygroscopic and tends to absorb moisture from the atmosphere. The amount of water absorbed is a function of the temperature of the hair and the partial pressure of the water vapor in the surrounding atmosphere. As the water content of the hair increases, the hair lengthens. As the water content decreases, the hair contracts.

The use of human hair for the measurement of relative humidity is by no means new. The **hair hygrometer** was, in fact, invented by De Saussure in 1783 and is still a common instrument for measuring and controlling relative humidity.

Strands of hair are anchored at one end (see diagram) and connected at the other through a mechanical linkage to a spring-loaded instrument pen. When the hair extends (or contracts) it moves the pen or pointer up (or down) the scale to indicate relative humidity directly.

Though the requirements of a good hair hygrometer are simple to state, they are not quite so simple to execute. Since one hair is not very strong, a number of hairs must be mounted in multiple. Each hair must be far enough away from its neighbor to have free access to the air. Yet all the hairs must be mounted under uniform tension, so that each does its share of the work.

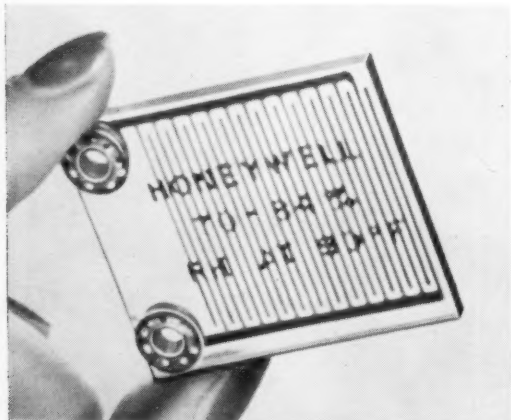
The hairs are extremely "tender" when exposed to high humidities and under such conditions can be overstressed, taking a permanent set and changing the calibration. This is a minor problem with indicators, a greater problem with recorders and a serious one with controllers.

This tenderness when exposed to high humidities is one reason why the hair hygrometer has a limited range. The hair itself will respond to relative humidities up to 100% but most manufacturers do not recommend its use above a value of 90%. At higher levels the margin of safety is very small and shifts in calibration are to be expected.

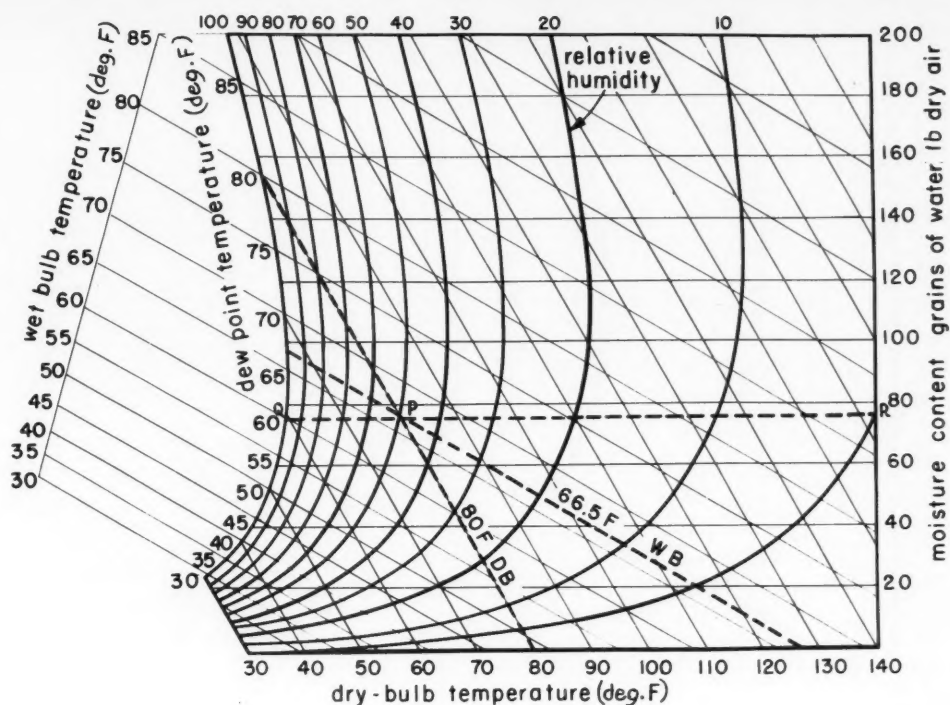
The lower limit for hair hygrometer operation is about 30% relative humidity. If hair is thoroughly dried by exposing it to low humidities, it will permanently shift calibration. Thus, while hair hygrometers commonly carry a scale reading from 0 to 100% RH, their actual field of use is limited to a range of approximately 30 to 90%.

The temperature limits are commonly regarded as 40 to 140 F, though neither limit is exact. At high temperatures the life of the hair is short and stability poor. At low temperatures, the principal limit is the extremely slow response of the system, due both to slowing down of internal diffusion of moisture with low temperature and to the extremely small quantities of water actually available in the atmosphere.

Once properly calibrated, the hair hygrometer can give accurate ($\pm 2\%$) measurement of relative humidities from 30% to 90% at temperatures between 60 F



A moisture sensing element converts relative humidity into electrical resistance for a hygrometer reading.



How to use the chart

Example. With a dry bulb reading of 80 F and a wet bulb reading of 66.5 F, use the chart to find: (1) Relative humidity; (2) dewpoint and (3) moisture content.

(1) Relative Humidity. Locate the point where 80 F dry bulb (on the horizontal scale) and 66.5 F wet bulb (on the left-hand inclined scale) cross. This gives

point P on the 50% relative humidity line.

(2) Dewpoint. Follow the dewpoint line horizontally to the curved dewpoint scale on the left. Dewpoint (shown by point Q) is 59.7 F.

(3) Moisture Content. Follow the moisture content line to the moisture content scale on the right. Moisture content at point R is 77 grains per lb dry air.

and 90 F. It can be used at temperatures between 90 and 140 F if ambient temperature variations are no more than ± 5 F. Portable hair hygrometers are often used to spot check air-conditioning installations.

More accurate measurement and control of relative humidity can be obtained by using a salt conductivity sensing element with a specially calibrated electronic instrument. The sensing element in this case is usually an electrical conductor, covered with moisture-sensitive lithium chloride.

Lithium chloride (the most frequently used material for humidity transducers) is hygroscopic, like hair or natural fibres. In common with other salts, lithium chloride is a non-conductor, but as soon as moisture is present, the lithium chloride absorbs it and forms a solution which is conductive. The more moisture the lithium chloride absorbs, the higher its conductivity.

This sensing element is used as one leg of the balancing bridge of an electronic potentiometer. Any changes across this electrical bridge are then translated by the potentiometer into direct readings of humidity.

The electronic hygrometer has considerable advantages

over the hair hygrometer. Properly calibrated, it is accurate to approximately $\pm \frac{1}{2}\%$ relative humidity and it responds to humidity changes within seconds.

With electronic measurement, only the sensing element need be located in the area being measured. This is a distinct advantage over the hair hygrometer, which must actually be in the area because of its integral measuring element. Electronic instruments can be used on central control panels as far as 1000 ft from their sensing elements.

With electronic instruments, almost any form of control can be used, either electric or pneumatic, whereas the hair hygrometer is usually only available with electric on-off control.

So far, the instruments discussed read directly in percent relative humidity. A **psychrometer** will also measure relative humidity, but will not read directly in relative humidity. A psychrometer is a device for measuring the moisture content of air by reading two identical temperature sensing devices (such as thermometers). One sensing element is directly exposed to the atmosphere and the other is covered by a wet wick.

The proper selection of instruments and controls plus a good practical

If you put shaving lotion on your face during a hot summer day, it makes your face feel cool. Yet the shaving lotion is at the same temperature as the air. Evaporation causes the cool feeling. Evaporation is a cooling action and shaving lotions are made with alcohol, which evaporates rapidly.

Wet and dry bulb measurements are based on the same principle. Since the wet bulb constantly evaporates water into the atmosphere in proportion to the amount of water vapor already there, it will read at a lower temperature than the dry bulb. The difference in the readings of the wet and dry bulbs can be converted into a reading of relative humidity.

All that is needed, to translate the readings into relative humidity, is a psychrometric chart. And this chart can do more than give a relative humidity reading: it can give a pretty complete picture of the entire water-in-atmosphere situation. It can convert wet and dry bulb readings into dewpoint or moisture content and other readings.

The chart is a graphic means of showing the relationship between the various humidity characteristics of air. And if it looks complex, it is only because the humidity relationships are pretty complex too.

Wet and dry bulb measurement is often considered the most accurate means of measuring humidity (particularly where the two temperatures are not close) and it affords exact control.

In wet and dry bulb systems, heating and humidification are usually accomplished separately. The dry bulb controls temperature; the wet bulb humidity.

In many applications, wet bulb temperature is significant by itself. Since moisture evaporates from the wet bulb at the same rate as it does from the surface of a product being dried, this temperature is actually an approximate measurement of product temperature during the initial drying stages.

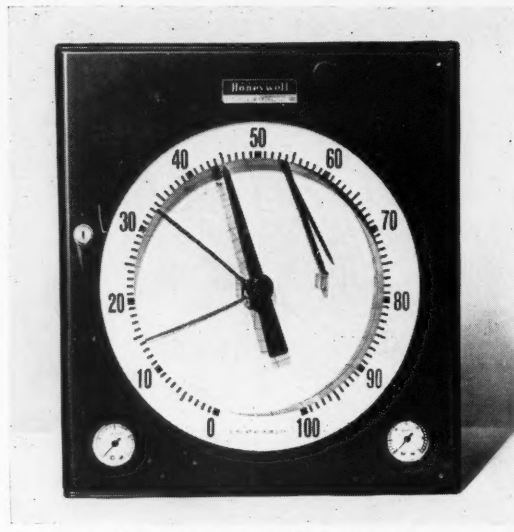
The simplest form of wet-and-dry-bulb psychrometer is the sling. This consists of two mercury-in-glass thermometers mounted on a frame and arranged with a swivel-mounted handle at one end so that it can be swung rapidly to give proper air velocity. The wet bulb is covered with a woven or knitted cotton wick.

To use a sling psychrometer, just wet the wick with clean water (within a few degrees of room temperature) and whirl the psychrometer for fifteen or twenty seconds in a regular circular path without any sudden or jerky motion. Stop and take readings quickly, reading the wet bulb first. It is important to read the wet bulb quickly because its temperature starts to rise immediately after the whirling stops.

The instrument is simple and inexpensive yet capable of accurate measurement if skilfully used. Chief advantages are its simplicity and portability. Its chief disadvantage is that, like all instruments requiring manipulation, careless handling leads to serious errors.

The sling psychrometer's principal field of use is in spot-checking air conditioning installations, in meteorological observations and in checking and re-zeroing humidity instruments.

Wet and dry bulb psychrometers for industrial use are made in a wide variety of types. A typical instal-



Electronic hygrometer gives direct humidity reading.

lation consists of a two-pen recording thermometer of the gas, vapor or mercury-filled type. One of the two bulbs is covered in some manner and kept wet.

The wet and dry bulb thermometer is the general purpose instrument in the field of drying: it is also used extensively in air-conditioning. Because of the complex relationship between wet bulb and either relative humidity or absolute humidity, the wet bulb cannot be used when humidity is to be controlled and temperature allowed to vary. Only at a fixed dry bulb temperature is the wet bulb directly convertible to relative humidity or dewpoint.

The chief advantage of the wet and dry bulb thermometer as a humidity measuring device is its greater accuracy over the hair hygrometer and its lower cost over the electronic hygrometer. Maintenance requirements are simple and, if followed faithfully, sustained accuracy is assured.

Its disadvantages are that its readings require interpretation by charts or tables to convert them into the units desired and that maintenance (while simple) must be carried out regularly or its accuracy will suffer.

Each wet and dry bulb sensing element assembly, like any other piece of equipment in a system, must fit your requirements perfectly. Porous tubes and knitted (or woven) wicks are used to keep the bulb wet. Water is supplied through standpipes, bottles or tanks.

If you have a readily available supply of clean water, you can use an assembly with standpipe and strainer. But if you don't have a readily available water supply (or if the water is not clean) you have to use either a water bottle or tank.

If you don't have a clean water supply, you should use distilled water. The solids dissolved in most tap water will soon clog the capillaries in the wick or tube and cause false temperature readings to be made.

and theoretical knowledge of "water-in-air" problems has become vital

Like all humidity sensing elements, the wet bulb assembly should be guaranteed a 15 fps flow of air to be sure it receives a good sample of the air it is measuring.

This is even more important in psychrometers than in hygrometers, because the air around the wet bulb soon becomes saturated with water vapor unless the air is changed constantly. And you can see the great errors that a collection of stagnant humid air around the bulb assembly would cause.

So, when you choose an assembly, you should decide whether you will need a fan. If you do, order it as part of your assembly, rather than adding it later, possibly after some wrong humidity readings.

Accurate matching of wet and dry systems is much more important than the absolute accuracy of each. For example, at 70 F and 70% RH two thermometers that both read 1 deg high would introduce less than 1% error. However, if one read 1% high and the other was correct, the error would be 4%.

The wet-and-dry-bulb thermometer is useful over a wider relative humidity range (5% to 100% relative humidity) and a wider ambient temperature range (30 to 200 F on the wet bulb) than either the hair or electronic hygrometer.

However, unless the thermometer is used with a transmitter, it must be placed within about 50 ft of the point of measurement. With a transmitter, remote measurement is possible up to 1,000 ft.

Thermometers are usually available with either electric contact control or a variety of modes of pneumatic control on both pens.

More precise measurement

In applications where more precise measurement and control is needed, electronic wet-and-dry-bulb systems are often used. The accuracy, stability, sensitivity and speed of response of these instruments insure most precise measurement and exacting control.

If thermocouples are used as wet and dry bulbs, the measuring instrument will have a potentiometer circuit. A thermocouple is a voltage-producing element. The small voltage it produces in response to heat is compared in the potentiometer against a known voltage and translated into a reading of temperature.

The operation of the resistance thermometer bulb, which is often used in wet and dry bulb systems, is based on the principle that the electrical resistance of conductors varies with changes in temperature. The resistance thermometer bulb is connected as one arm of a measuring bridge. Its resistance to current flow is then translated by the instrument into a temperature reading.

Electronic wet-and-dry-bulb systems are equally suitable for remote measurement from central control boards. A potentiometer can be placed up to 1,500 ft from its sensing element. A resistance thermometer has a maximum distance from instrument to sensing element of approximately 2,500 ft.

These instruments have a relative humidity range of 5% to 100% and can be used in a wet bulb tempera-

ture range of 30 to 200 F. Just as the electronic hygrometer is more expensive than a hair hygrometer, the electronic wet-and-dry-bulb systems are more expensive than wet-and-dry-bulb thermometers.

In some applications (such as small air-conditioning systems) there is no need to indicate or record relative humidity and extremely precise control is not essential. For such uses, a wide variety of non-indicating controllers are available.

These devices are the least expensive of all humidity controllers. Most frequently they use hair or salt conductivity sensing elements and are available with electric contact or limited forms of pneumatic control.

For non-indicating wet and dry bulb measurement, two non-indicating thermometer controllers can be used, the wet bulb thermometer controlling temperature, the dry bulb controlling humidity.

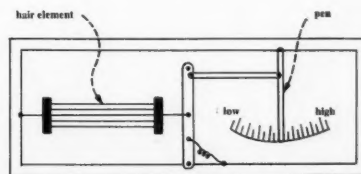
Until recently, dewpoint measurement has been rather neglected industrially. Though basically simple, dewpoint measurement has been difficult to adapt to remote reading and continuous indication and recording.

The classical method of determining dewpoint is by slow cooling of a polished surface until condensation takes place. The temperature of the surface when the first droplet appears is the dewpoint.

Mechanized forms of this method are made to give continuous recording. In these recorders, a mechanical refrigeration system is used to provide cooling; a photocell "sees" the condensate which forms on a bright metal target and controls the refrigeration, and a recording electronic potentiometer (with thermocouple sensing element) provides a dewpoint record by recording the temperature of the target.

The target is alternately cooled and heated to cause the condensate to appear and disappear. The dewpoint record on the recorder chart appears as a sawtooth line.

This automatic operation eliminates the human errors of too-fast cooling and failure to note the first appearance of frost. It suffers from the disadvantage of being inherently complicated and hence costly. Also, this type of recorder cannot ordinarily distinguish between water dewpoint and other condensibles. Its principal use has been in the metallurgical field for measuring moisture content of controlled atmospheres.



Hair element changes length in response to humidity conditions to move pointer.

Ideas round-up

Big squeeze makes a pump smaller and cheaper

A line of variable displacement hydraulic pumps for aircraft applications that achieves a 37% saving in weight and a 33% reduction in size is now available from Vickers Incorporated. The improved pumps feature a redesigned yoke and a housing made of magnesium-zirconium alloy (fig. 1).

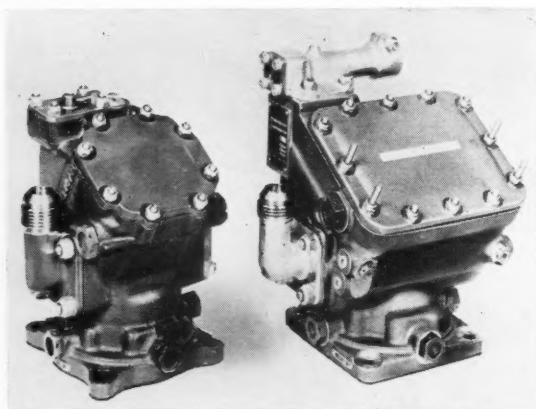
Vickers pump design and development experience over the years showed that it was best to retain the Vickers piston-type design using a yoke arrangement to vary pump displacement.

Redesign of the yoke itself forms the basis for the over-all improvement. The previous yoke (fig. 2(a)) was an aluminum U-shaped member supported in the housing between two pintles that passed through its arms. It contained internal passages for carrying oil from the point of entry into the pump to the valve plate and

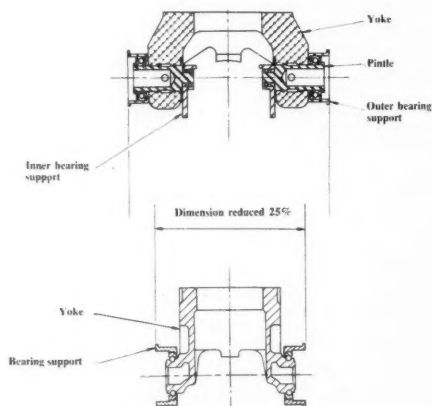
cylinder block (where pressure was developed) and then returned oil under pressure to the pressure outlet port.

The new yoke (fig. 2(b)) is an alloy steel casting having integral pintles. The steel provides high strength despite the extremely thin walls of the fluid passages, and the new part weighs less than the former aluminum yoke.

Integration of pintles and yoke in the high strength steel casting does away with the inside yoke supports and substantially reduces the dimension across the pintles. The new yoke design provides a smoother passage for the oil and avoids obstructions to fluid flow inherent in the old design. With inside yoke supports no longer required, two bearings are also eliminated. The new integral pintle construction eliminates the yoke-to-pintle sealing requirement. (210)



The new pump and previous pump of comparable capacity.



Showing how the old pump (top) underwent reduction.

Weightsaving aluminum can replace copper

In order to save weight, development is progressing at CGE to substitute aluminum for copper in motor windings.

Since copper is standard for present electrical conductors, somewhere in the circuit the need for a copper-aluminum joint arises. To facilitate customer installation, copper leads on the equipment are a necessity. A transition joint was therefore designed as the joint between the aluminum windings and the copper lead straps.

The Peterborough engineering laboratory is presently concerned with the method of joining and joint design. Many satisfactory ways are available to join aluminum to copper but some have limitations, such as high temperature and lack of portability. The process must be flexible enough to be used in position on a winding machine by the winding operator. For these reasons,

soldering was the method that it was decided to adopt.

The joint design for soldering must be uncomplicated to allow good solder flow.

In aluminum soldering there may be difficulty in:

1. Obtaining good tinning through the aluminum oxide

2. Obtaining a non-corrosive flux or easy flux removal

These requirements are satisfactorily met by a set of solders and flux manufactured by the Aluminum Company of America. These are Alcoa 804 Solder and 64 flux.

The heat for the soldering operation can be supplied by a large soldering iron, carbon tongs or oxy-acetylene torch. Solder is preplaced in the joint so that no more heat than necessary will be applied.

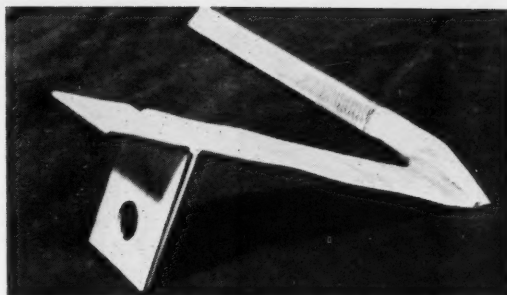
If heating is done with an oxy-acetylene torch, the flame must not be directed on the flux and the joint should be brought to soldering temperature by heating the surrounding area.

Close attention must be paid to the operation to obtain uniform heating. The flux serves as an excellent heat indicator and turns dark brown when overheated.

Although the flux residue is non-corrosive it is removed with warm water for the sake of appearances and to facilitate insulating.

Since aluminum and copper are widely apart in the electrochemical series, the joints must be protected from humidity or salt fog atmospheres to prevent deterioration.

(211)



This joint used Alcoa 804 solder and Alcoa 65 flux.

Copper's conductivity and the strength of steel

Development of a high-strength steel communications wire with a heavy copper coating was announced today by National-Standard Company, producers of specialty wire for industry.

Although the biggest volume application of the new product is expected to be in telephone, telegraph and railroad signal lines, the wire will meet such requirements as high tensile strength (up to 250,000 psi), electrical conductivity, bright finish and resistance to fatigue and corrosion. The copper coating is joined to the steel core in a permanent bond that permits twisting, stranding, weaving, braiding, bending or flattening of the wire without rupturing the bond.

The new wire is a significant addition to the Copper-

ply line and is available in two grades, one with 30% and the other with 40% conductivity, in both high and extra high strength classes. Earlier Copperply wire (introduced in 1953) contained 5 and 10% of copper by weight. Its primary applications were: television antenna lead-in wires, tinsel jewelry chain and building tie wire.

Heavier coatings were developed specifically to meet the needs of the communications industry. In addition to costing less than solid copper, the new wire has the reinforced strength of a steel core. This allows significant economies, by doing away with about a third of the poles required for supporting solid copper lines. It also provides a higher safety factor, less sag and greater resistance to storm and ice damage.

Numerous applications are also expected for the product outside the communications field.

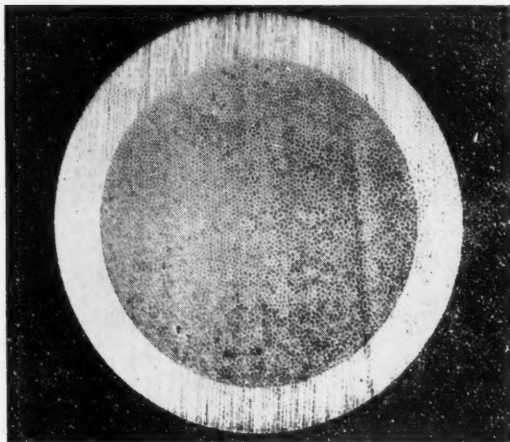
The wire is produced in all standard sizes from no. 1 to no. 12 AWG. The core is available in a wide range of strengths and hardnesses. Initial production is concentrated on existing commercial specifications.

Three years of research were required to produce the new heavy-coated wire with the same dimensional accuracy and bonding strength as lighter wires. Uniformity of coating thickness is held within 1% of wire diameter. The production process is based upon improvements in the Kenmore plating process, acquired by National-Standard in 1955.

Helical lengths of steel wire are electroplated in a special bath that produces an unbreakable bond of copper and steel, and are then finished to size in precision drawing operations.

The process enables the production of steel cores with a wide range of physical and electrical characteristics, and frees the company from the steel analysis restrictions imposed by other processes.

(212)



Microphoto of new wire shows uniformity of bond.

A year's timekeeping on a shirtbutton battery

A new era in timekeeping was ushered in recently with the introduction of the world's first electric wrist watch, perfected after 10 years of research, development and testing by the Hamilton Watch Company.

No larger than a conventional wrist watch, the electric watch offers the highest accuracy and depend-

ability ever achieved, and incorporates the first basic change in watch construction in almost five centuries.

The radical structure of the electric watch completely eliminates the mainspring, an integral part of portable timekeeping since it was invented in 1480 by Peter Henlein of Nuremberg, Germany. The new watch

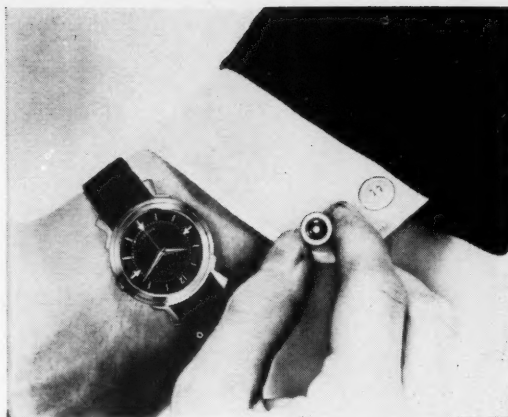
Ideas round-up continued

is the only one in existence which runs without winding or without periodic agitation.

The watch movement is so exquisitely engineered that a tiny energizer (the size of a small shirt button) will run it for a minimum of 12 months. In fact, Hamilton's electric watch would run for more than 20 years on the energy needed to operate a 100-watt bulb for no longer than a minute.

The electric watch operates on chemical energy stored in a tiny energizer. This energy is converted into electrical power as it releases a stream of electrons through a coil of fine wire fixed on a balance wheel. The electrical energy (through interaction with permanent magnetic fields) causes the balance wheel to oscillate. This oscillation is the mechanical energy which runs the watch.

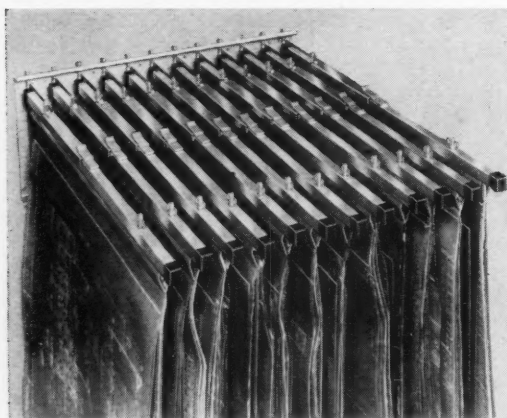
The over-all result is a precise miniature power plant built into the balance wheel, which in turn powers the gears and moves the hands of the watch. In the past,



An Energizer shown in comparison to a shirt button.

the balance wheel only controlled the power furnished by a mainspring. In the electric watch it furnishes its own power and controls it as well. (213)

Take the mess out of plan filing



It is made of aluminum with plastic tips. Wing nuts and studs never need come in contact with the prints.

A new vertical filing system has been designed to hold engineering prints in any available rack or plan file without the necessity for punching or drilling holes or mutilating the plans in any way. Simply loosen two wing nuts and Plan Hold (as it is called) snaps open, wide enough for 150 prints. Tighten wing nuts and the prints are secure. The device will hold even a single print without slipping. One print (or many) may be added or removed quickly and easily.

It is made of sturdy structural aluminum, satin finished, with protective plastic tips to safeguard against scratching or marring. Sides and edges are rounded for comfortable handling. Wing nuts and studs are never in contact with the prints, and are located at the end of the holder so that the prints always lie flat. They can never be torn or perforated by protruding nuts or bolts.

This versatile unit puts your plans within easy reach at all times. The Rolling Stand unit is easily moved from room to room on its non-marking Atlasite ball bearing casters. Units may be used in batteries or back-to-back for centre of room locations. (214)

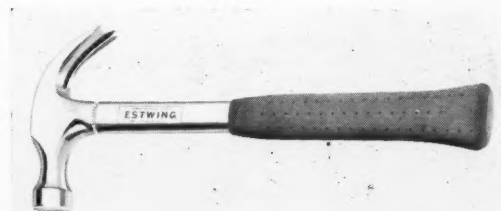
These hammers are one-piece forgings

Professional carpenters and do-it-yourself enthusiasts alike have acclaimed the feel, comfort and balance of the new Estwing "unbreakable" hammer.

The safety features of the forged, one-piece construction are important to the man who uses a hammer. Because there are no welds, joints or pins to loosen or break, heavy blows can be struck without the danger of the head coming loose or flying off. And handles cannot splinter or break.

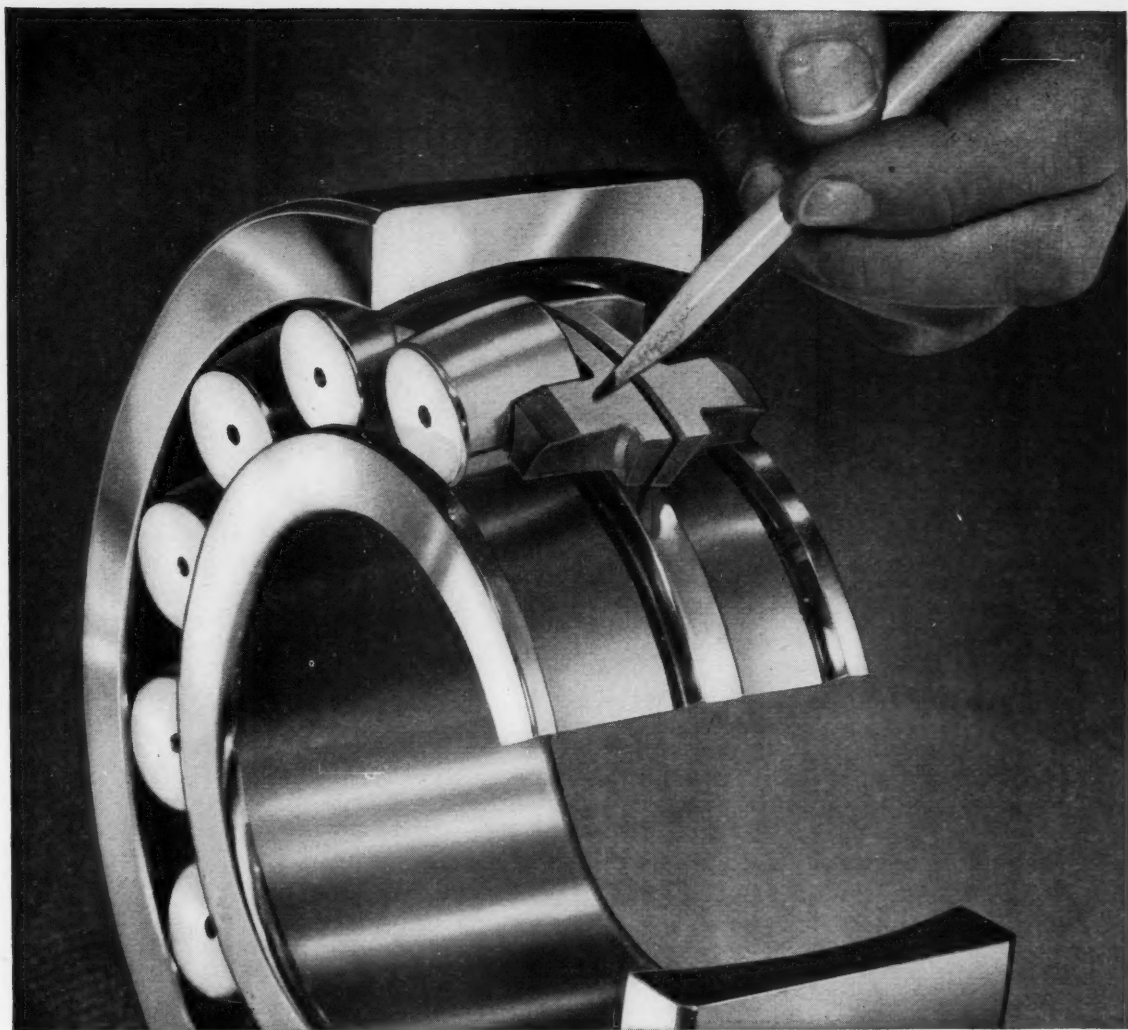
The hammers are forged in a single piece from tough tool steel. The handle is formed by pressing and

(Continued on page 56)



Estwing hammer has tubular handle and cushioned grip.

TORRINGTON SPHERICAL ROLLER BEARINGS



Land-riding cages for longer life!

These fully machined cast-bronze, land-riding cages—one for each path of rollers—are important performance builders in TORRINGTON's Spherical Roller Bearings. The one-piece retainers keep the rollers perfectly aligned at all times, even under conditions of shock load and sustained speeds. Lubrication is more effective, too, as the lubricant has easy access to vital points of contact between rollers and races.

This feature is typical of TORRINGTON's design, made possible through long experience in serving industry with the finest in precision bearings. That's why it pays to look to TORRINGTON first when your application calls for Spherical Roller Bearings. They're available from stock with either straight or tapered bore, for shaft or adapter mounting.

THE TORRINGTON COMPANY
925 Millwood Road, Toronto 17, Ont.

*District offices and distributors in principal cities of
United States and Canada*

TORRINGTON BEARINGS

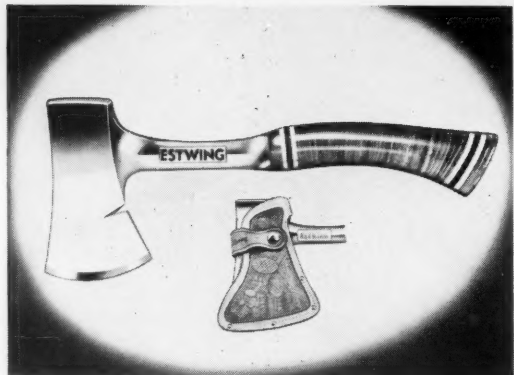
Spherical Roller • Tapered Roller • Cylindrical Roller
Needle • Ball • Needle Rollers

Ideas round-up continued

laminating 50 individual leather washers on the steel shank to form a shockproof, nonslip grip that is both durable and comfortable.

Estwing makes tinner's setting and riveting hammers; crating, curved and straight claw hammers; and engineers' double face and ball peen hammers in an assortment of weights, as well as hatchets, axes and small prospectors' picks. All feature the one-piece unbreakable construction. The company has also introduced recently a tubular steel handle with a permanently bonded cushion grip.

After tempering, all these tools are treated with Bonderite to help them resist corrosion and to aid in the bond between metal and leather. (215)



An axe with leather grip on forged one-piece handle.

Small hole diameters are quickly checked

A new precision tool manufactured by the Allied Products Division, Hamilton Watch Company, permits rapid and highly accurate measurement of small hole diameters.



Gauge permits measurements of holes within 0.0005 in.

The device, known as the Kwik-Chek hole gauge, is so simple to use that hole diameters can be measured in 5 sec or less. Accuracy and readability of the gauge is 0.0005 in., the direct reading scale being marked in increments of 0.001 in. and equipped with a 2½X magnifying lens. A complete set of three gauges covers hole diameters from 0.025 to 0.380 in., each unit having a hole diameter range of 0.125 in.

The gauge is composed of three basic functional parts: a tapered retractable needle, a precision clutch mechanism and an easily-read magnified scale. Hole diameters are measured in four easy steps: (1) needle is released by pushing the clutch button; (2) needle is inserted in hole; (3) barrel is pushed down flush with the piece being measured; and (4) gauge is removed and diameter read directly.

The gauge is a valuable cost and time saver to anyone concerned with precision hole diameter measurement, such as machinists, tool and die makers, engineers and inspectors from the model shop on through production to quality control and inspection. In their size ranges, they can replace over 700 costly "go" and "no-go" plug gauges. (216)

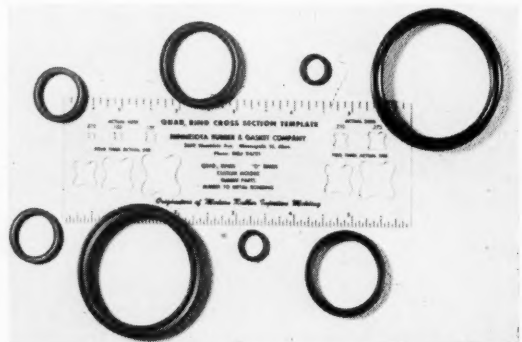
This template makes seal drawings accurate

In order to permit faster and more accurate drawings of the Quad Ring seal, Minnesota Rubber and Gasket Co. has recently issued a template ruler.

The ruler will be given to all design engineers whose companies are now using (or intend to use) the new four-lipped ring in various sealing applications.

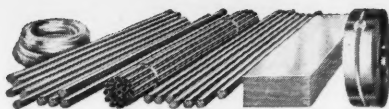
Five available cross sections (.07, .103, .139, .210 and .275 in.) are cut out of clear styrene plastic to true size and contour. The three smaller sizes have cutouts enlarged four-times below them, whilst the two larger sizes are stamped out below in twice full-size. The 6 in. template-ruler is marked off in divisions of 1/8 and 1/16 in.

Quad Ring seals have no parting line on sealing edges and they were designed to eliminate such common faults as: spiral twist failures, rolling with pulsat-



The ruler permits faster drawings of Quad Ring seals.

(Continued on page 58)



NORANDA COPPER AND BRASS LIMITED

COPPER ALLOY BULLETIN



MILLS AT MONTREAL EAST—OFFICES IN MONTREAL, TORONTO, EDMONTON, VANCOUVER
Export Department, P.O. Box 1238 Place D'Armes, Montreal, P.Q., Canada

Copper and Copper-Alloy Tubing for Fabrication— Selection and Ordering Information

We have never tried to count the number of products that can be fabricated, in whole or in part, from readily available, standard Noranda copper and copper alloy tubing. They must run into the thousands. There are probably examples nearby as you read this... lighting appliances, furniture ferrules and plumbing fixtures are only a few.

The standard Noranda alloys are engineered to cope with many different applications. However, experimental research continues to develop more specialized copper-base alloys to anticipate new technological demands. In most cases, the useful range of dimensions and properties available for each standard alloy can be selectively applied by our technical specialists to fit your particular product and methods. Following is a brief description of regular Noranda tube alloys for fabrication.

Noranda Tubing for Fabrication

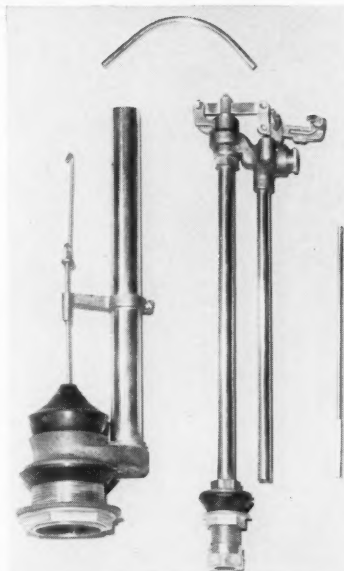
DEOXIDIZED COPPER 110—Approximately 99.90% copper and 0.02% phosphorus. This is made in many sizes and wall thicknesses for a variety of end uses; wet-heat fixtures, pressure and lubricating systems, fluid lines used in many process industries.

HIGH CONDUCTIVITY COPPER 102—99.9% minimum copper content. Often referred to as Electrolytic Tough Pitch Copper. Its high electrical conductivity (100% minimum as annealed) makes it ideal for current-carrying applications such as bus tubing and pole line hardware.

COMMERCIAL BRONZE 25—Approximately 90% copper and 10% zinc. Somewhat stronger and harder than the coppers. Used for rotating bands for projectiles and hardware for outdoor purposes.

RED BRASS 85—Approximately 85% copper and 15% zinc. Its corrosion-resisting qualities make it especially adaptable for use in plumbing fixtures, aircraft radiators, pump parts and other applications that encounter corrosive attack.

CARTRIDGE BRASS 69—Approximately 70% copper and 30% zinc. Very ductile. Used for severe forming opera-



In the plumbing and heating industry, brass is the standard by which all other metals are judged. These float and flush valves made by American Standard Products (Canada) Limited, Toronto, are typical of many applications which rely on versatile Noranda Brass Tubing.

tions in general manufacturing. It is used in decorative housewares, electrical appliances and automobile radiators.

LEADED BRASS 18—Approximately 67% copper, 0.5% lead, with the balance zinc. Offers good machinability yet stands up well under bending, flanging and other cold-working operations. This is the standard yellow brass alloy for general purposes.

Facts to Help You in Ordering Noranda Tubing for Manufacturing

Dimensions

In most cases, requirements can be met if the customer specifies the outside diameter and wall thickness of the alloy he wishes to use. There are instances

where special forming methods are involved where inside diameters are important. It is well to mention these conditions when ordering material.

Lengths

Noranda tubing for fabrication is available in the following length specifications:

1. In random lengths (between 7 and 14 feet; at the mill's discretion).
2. In lengths or multiples of specified piece lengths.
3. Cut to exact lengths.

Tolerances

To ensure concentricity and roundness well within standard tolerances, Noranda tubing is thoroughly inspected. Dimensional tolerances may be specified with respect to any two, but not three, of the following:

1. Outside diameter.
2. Inside diameter.
3. Wall thickness.

Commercial tube tolerances are sufficient to meet the large majority of applications. Usually, fabricators whose requirements are more exacting will find that they can be met by Noranda at small added expense.

Temper

Unless otherwise specified, Noranda tubes are finished and delivered "commercially hard." It is most important that the customer's end use be specified in order that temper requirements can be met. This is especially true in cases where tubing is to be bent, coiled or flanged. Often a range of tempers may be available within a standard specification. In any case, time and expense can be saved by mentioning the required temper on the original order along with the specification designation.

Surface

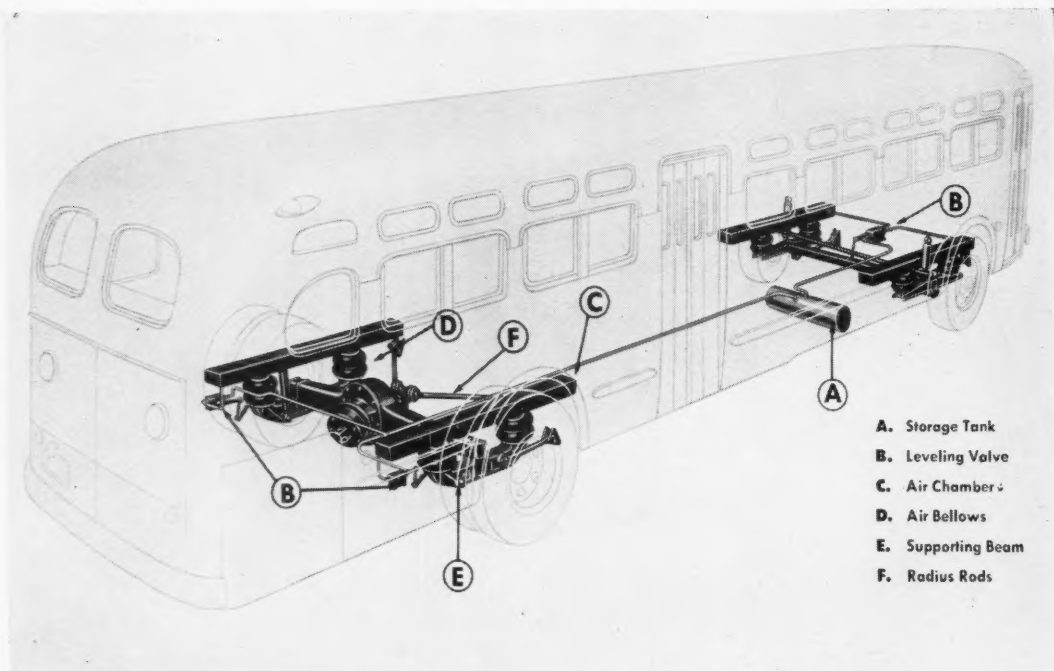
Red Brass tubing is always supplied with surface suitable for polishing and/or plating. When specified, this quality of surface is available at no extra charge on all Noranda tubing.

Whatever your present—or intended—requirements, Noranda will be glad to have its salesmen and Technical Staff discuss them with you. Our experience in recommending and supplying copper and copper-base alloy mill products for fabrication has been acquired in successfully solving many a tough metal-working problem. By calling our nearest sales office you can put it to work for you. (2180)

ing pressures and leakage at low pressure differentials. The company reports that the seal is highly effective in reciprocating, rotary and static installations.

It was decided to issue the template-ruler because

of the unusual cross section of these seals, which previously were difficult to draw to correct scale and shape in designing components. It is hoped that the use of the template will save a lot of time. (217)



This ghost drawing shows how one of the new air suspension units will look installed in passenger coach.

Coach with the "floating on air" feel

Coaches that ride on air, giving unparalleled riding comfort for driver and passenger, are now in service.

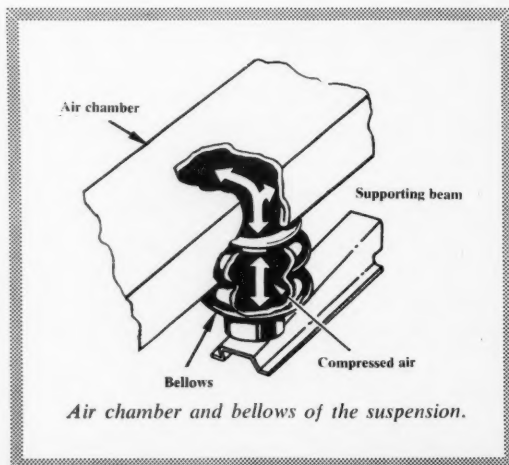
The coaches are a product of General Motors Corporation, whose engineers spent 12 years perfecting the new development, which is called Air Suspension, since the coach body "floats" on compressed air.

This new type of suspension replaces conventional metal leaf springs. Compressed air from the coach air system storage tank (A) is supplied to the leveling valves (B) which in turn meter it to the suspension system.

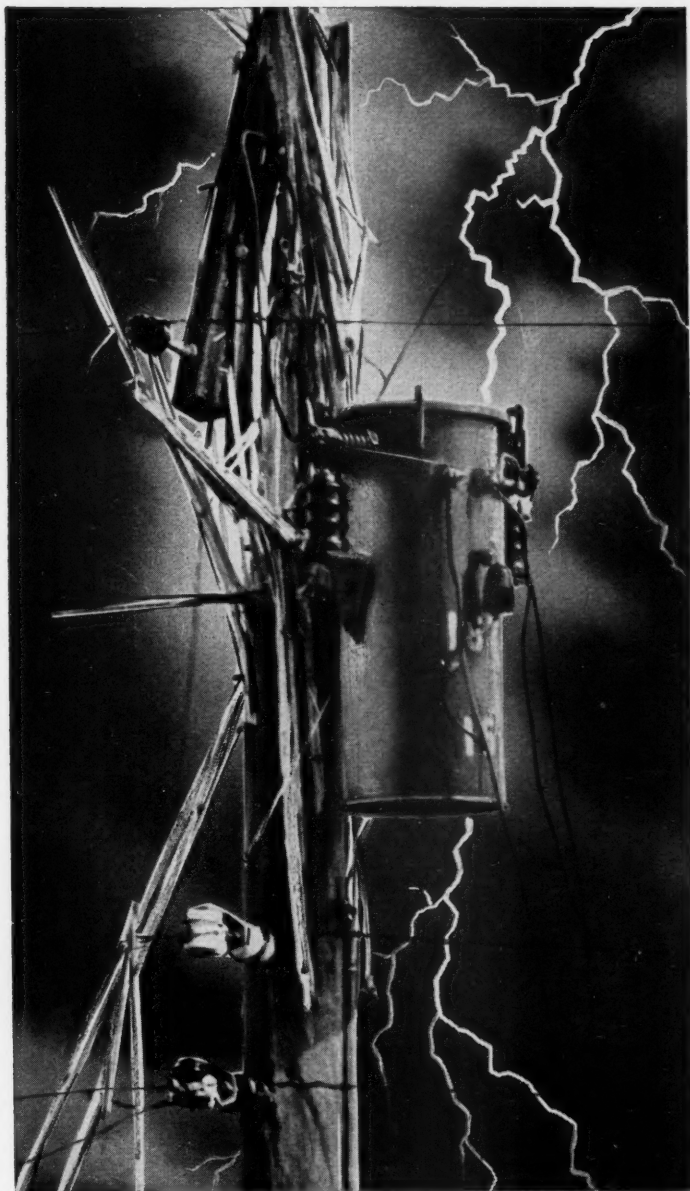
There are three leveling valves (one at the front and two at the rear axle) and they are actuated by the relative motion between the body and the axles. As the coach is loaded, these valves automatically meter more air into the system, increasing the air pressure to compensate for the added weight. This keeps the coach body at its original level.

The leveling valves are designed, however, not to respond to the rapid relative motion caused by road irregularities, particularly at high speed.

(Continued on page 60)



THE NATIONAL SCENE

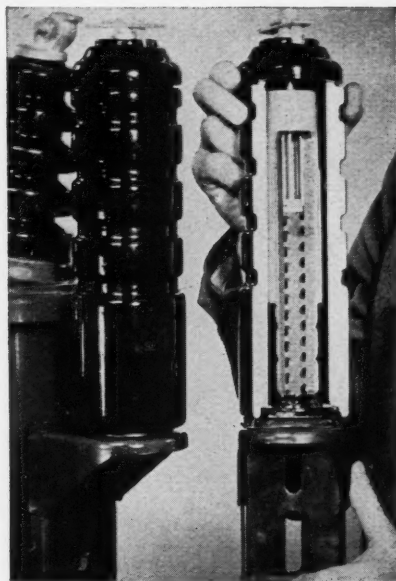


NATIONAL HELPS TAME LIGHTNING BOLTS to keep electrical equipment in service. Lightning shattered this line pole but couldn't knock out the Westinghouse distribution transformer. Reason: a "safety valve" of National Vulcanized Fibre. A diffuser assembly of this tough insulating material smothered the explosive electric arc and kept the transformer on the job—without a moment's interruption in power supply.

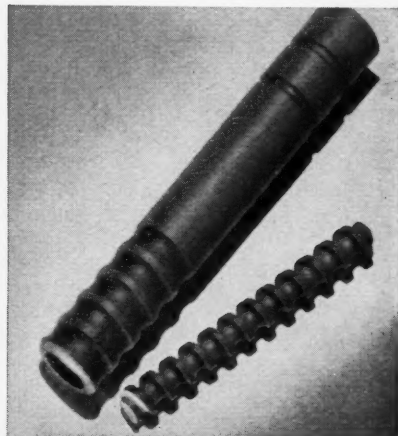
NATIONAL CAN HELP YOU reduce unit product cost or improve product performance at no added cost. Here's why: You can select the "one best material" from over 100 grades of PHENOLITE®, Vulcanized Fibre and NATIONAL Nylon—without compromise in properties or cost. You can simplify production and purchas-

ing with the timed delivery of 100% usable parts—from a single reliable source. You gain competitively with National's new materials and grades—the direct results of programmed materials-research.

You benefit by calling National first. Check SWEET'S PD FILE 2b/Na, the Telephone Directory yellow pages, or write direct to Dept. A.



NATIONAL OFFERS INDUSTRY'S BROADEST LINE of basic materials—more than 100 different grades and combinations. Heart of this lightning arrester, for example, is hard, dense, dielectric bone fibre—specially selected to absorb tremendous surges of voltage—tame and quench destructive arcs—dissipate intense heat and dangerous gases harmlessly. Name the combination of properties you need—electrical, mechanical, chemical. You'll find the "one best material" at National.



NATIONAL FABRICATES PRECISION COMPONENTS for hundreds of electrical, electronic, mechanical and chemical applications. Case in point: this sleeve and spiral insert were machined to Westinghouse design specifications. Parts like these exemplify National's fabricating skill. From the simplest punching to the most complex forming or screw machine operation, you get the same result: 100% usable parts.



NATIONAL

FIBRE COMPANY OF CANADA, LTD.
ATLANTIC & HANNA AVENUES, TORONTO
1411 CRESCENT STREET, MONTREAL

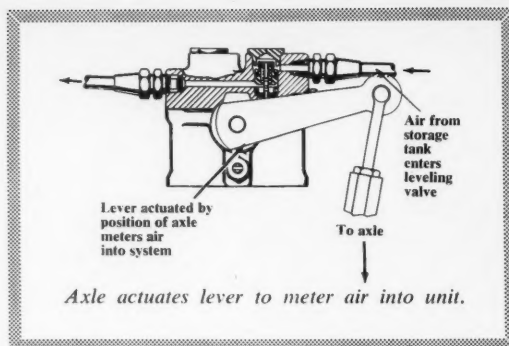
Ideas round-up continued

Each of the four air chambers (C) consists of a rectangular sheet steel box with large openings into two rubberized nylon tire fabric bellows (D) mounted below it, forming a single compartment of compressed air.

The air bellows serve as a flexible connection between the body and the axles. Flexing of the air bellows results in an alternate increase or decrease in the air volume and pressure within the air chamber. This action absorbs road shocks, just as an inflated rubber tire acts as a cushion against shock from road roughness.

Aircraft type, direct double-acting shock absorbers are used at both sides of the front and rear axles to control rebound and further cushion the ride.

Radius rods (F) maintain the position of each axle against lateral, longitudinal and torsional movement.



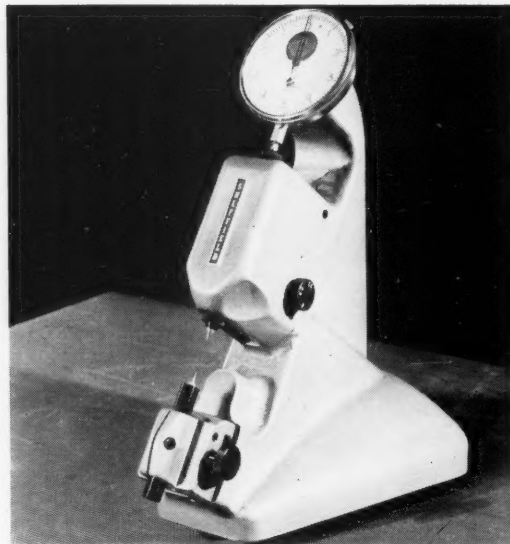
Rubber mounted, they require no lubrication, function noiselessly and positively position the axle relative to the body thereby giving unusual riding stability. (218)

A check on pitch diameters of threaded parts

It is now possible to check the pitch diameter of any threaded part having external screw threads up to 1½ in. diameter. Developed by the Sheffield Corporation, the new instrument (which requires no special wires or attachments) can be quickly and simply operated mechanically to obtain pitch diameter readings on a large, easily read dial graduated in 0.0001 in. To achieve more precise measurement the thread checker may be adapted for use with Sheffield single-column Precisionaire air gauges and Plunjet air gauging cartidges or with the company's new electronic amplifier and pick-up unit.

The device uses one pair of gauging tips for each pitch of thread to be checked. These tips have threaded shanks and are interchangeable so that it is possible to check any pitch of any straight screw-thread. A knob conveniently located on the gauging head enables the operator to select either a 16 oz or a 40 oz gauging pressure. Other gauging pressures are available to meet special requirements.

The part is rolled slowly into position between the gauging tips and any PD variation read on the indicator dial. Setup is made from a master thread plug or a previously calibrated part. (219)



The instrument needs no special wires or attachments.

Jet engines get a new high-strength alloy

There is now a high-strength alloy for jet engine components operating in the 1200-1400 F range. Known as J1300, it is an iron base alloy with a strength-to-weight ratio 25-40% better than comparable materials in this temperature range today. Its operating temperature is 100 F higher than materials now in use.

The new alloy had its start during an investigation of the effects of various alloying elements, begun in the GE Research Laboratory during the 1940s. When sufficient detailed information on these effects had been gathered, a program (known as Project Vitamin) was launched to develop new materials on this basis.

The composition of J1300 was conceived on the

basis of phase diagrams and newly gathered research information. By means of statistical methods, relatively few experiments were sufficient to verify the accuracy of the original calculations. Among the requirements to be satisfied were: low content of strategic metals (no cobalt or columbium and little nickel) and a life of 1,000 hr. or more at 15,000 psi and 1500 F. When it was clear that these goals had been achieved, the new alloy was turned over to the aircraft gas turbine division.

Their metallurgists proved it to be an excellent high-strength bar and forging material for the medium temperature range, and to have great potentialities as high-strength sheet in the 1200-1400 F. range. (220)



HE'S SAVING A STEP IN YOUR PLANT!

Here, in the Glidden Technical Service Department's pressurized finishing room, a refrigerator door is being sprayed in a water-wash spray booth. The purpose of this test is not merely to find out how the finish will perform, *but how it will perform on your own production line.*

In such tests the actual products to be finished, the equipment to be used, and the conditions under which the job will be done are all reproduced as accurately as possible. Only in this way can the *actual performance* of a finish be evaluated.

In other important ways, Glidden Technical Service can be a valuable help in solving problems connected with your use of industrial product finishes. And, if you wish, these services will be extended right into your own plant or in the field.

In addition, the complete research facilities of the Glidden Laboratories are at your command for the development of special finishes for your company's particular needs.

All in all, we believe you'll find that these are the most helpful services of their kind that you have ever experienced. Why not try them?



INFORMATION YOU'LL VALUE!
This Booklet outlines all Glidden Technical and Laboratory Services—and how you can profit by them. We will gladly send a free copy to plant executives on request. Just write to:

THE GLIDDEN COMPANY LIMITED • Technical Service Department, 351 Wallace Ave., Toronto, Ont.



Viewers that fit on a drafting table are part of the system. Draftsman in background holds 105mm negative.

Old drawings are starting a new life

A new system successfully duplicates large engineering drawing sheets

Blueprinters have for years sought a method of reproducing or repairing faded, torn or soiled drawings without the high cost of re-tracing them line by line.

Conventional methods using blueprint diazo or reflex papers have failed since such procedures involve the passage of light through the original to expose the copy. This emphasizes existing faults and calls for extra artwork.

Microfilm (up to and including 70mm) has been unsuccessful because of the loss of detail in reducing and then reproducing large engineering drawings. As a general rule, enlargements beyond 10 diameters are acknowledged to be unsatisfactory.

Large cut film negatives have been tried again without success because conventional photographic equipment and techniques were used.

Recently, however, a new 105mm system has successfully duplicated engineering drawing sheets as large as 36 in. by 54 in. and even larger roll lengths.

Second originals by this method (which is called Micro-Master) have been consistently better than the true originals and a 75% improvement on the average (without artwork) has been demonstrated in the restoration of soiled or worn tracings.

The new process was developed in association with Keuffel & Esser Co. Equipment to provide a nationwide reproduction service is now being installed in key industrial centres throughout Canada and the U. S.

When tracings are to be reproduced, they are first mounted on a vacuum easel and photographed to pick up the maximum detail in every instance, even in the case of material that is soiled.

Normally, soiled copy requires the photographer to adjust his exposure to burn out the background, and this in turn also burns out the weak lines.

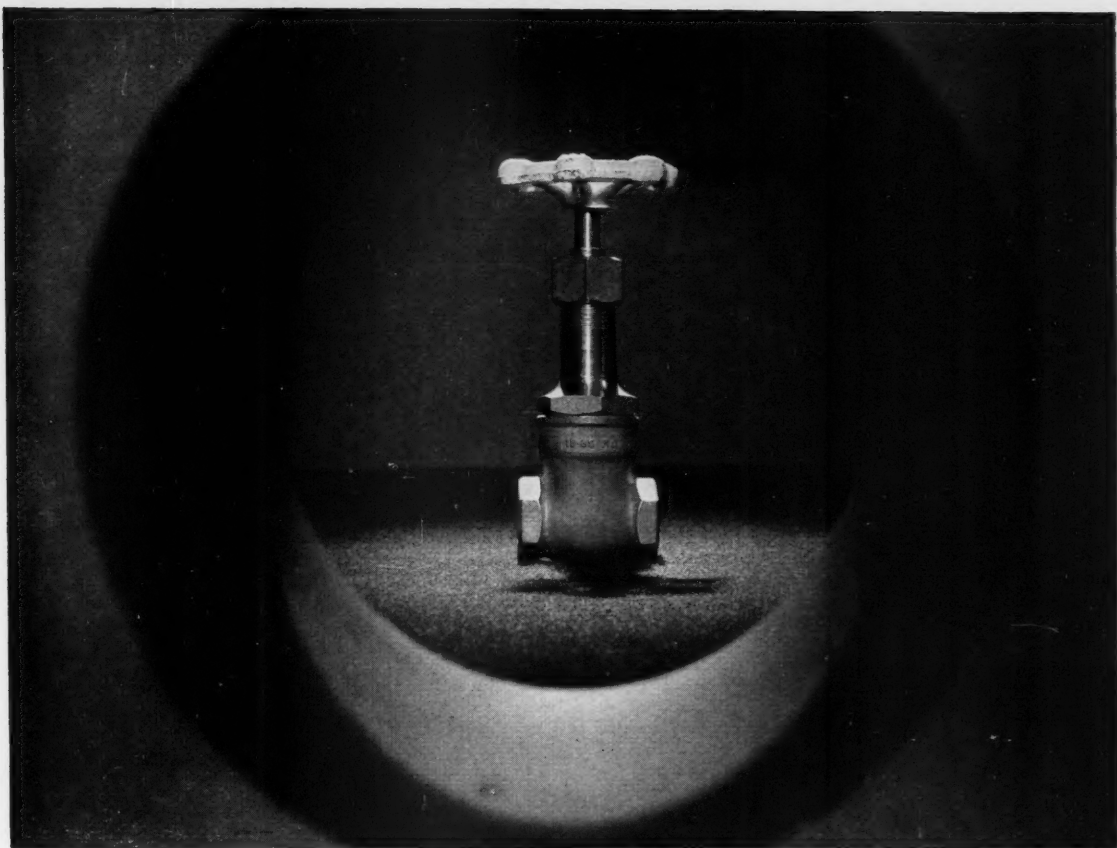
In Micro-Master, however, the weakest line image is captured without respect to background dirt. Soil and mottle are then clipped out of the projected image with exposures timed to the nearest tenth of a second.

When the 105mm negative has been developed and dried, it provides a perfect image of all line work entirely free from pinholes. Micro-Master negatives do not require corrective opaquing and need no artwork, except to delete unwanted features of the drawing itself.

The negative is, of course, a faithful reproduction of the original. It shows all the ragged edges of a worn tracing, all the taped men's, all the easels.

Yet when the negative is printed, most of these unwanted marks are dropped out and only the lines of the drawing come through. This is because of a special optical system and extremely precise process.

The projector is probably the first in the world to be designed specifically for line work. It is capable of capturing and holding light lines. And even drawings that are virtually illegible to the naked eye in the original can become perfectly readable in the second original. ★



RIGHT

There is no place for corrosion in your business. It's simply a matter of selection . . . of using the *right* metal or metals throughout your entire fluids handling system.

In focusing your attention on a valve we're emphasizing the fact that no single valve — *no single item* in the entire system can be overlooked.

In this connection we want to emphasize the right choice of metal — in all valves, pipe and tubing, flanges and fittings.

That is our business. To help you choose the right metals.

We have experience in meeting the varied needs of industry backed by the most complete research facilities available in the field.

We carry large warehouse stocks in stainless steels and aluminum.

Our recommendations are unbiased. Our service is geared to your needs.

Call on us. We specialize in meeting your needs.

ALLOY METAL SALES LIMITED

Distributors of
STAINLESS ALLOYS AND ALUMINUM IN ALL COMMERCIAL MILL FORMS

181 FLEET ST. EAST, TORONTO 2, ONT.

92 MONTÉE DE LIESSE, VILLE ST. LAURENT, MONTRÉAL, P.Q.

20 MONTCALM ST., WINNIPEG 5, MAN.

T H E R E I S N O P L A C E F O R C O R R O S I O N I N Y O U R B U S I N E S S

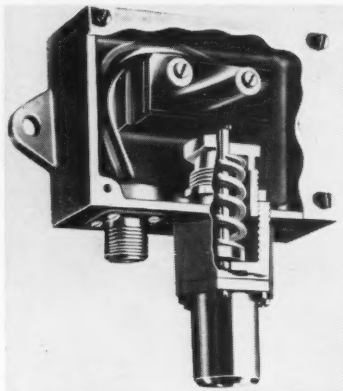
DESIGN ENGINEERING MARCH 1957

New products & materials

New items which can help you on the job

Rock drill

The world's lightest self-contained gas-line-driven portable rock drill (it weighs only 53 lb) with drill speeds up to 26 ft per hr, is being introduced to Canada by **Atlas Copco Canada Ltd.** The Cobra, equipped with a one-cylinder, two-stroke motor, operates without compressed air or electrically and averages about 75 ft on a gallon of gasoline. Less than two thirds the weight of any other gas-driven portable drill now in production, the machine features a floatless carburetor which permits drilling in all positions from straight down to 45 deg upward. Air-blown flushing cleans the hole without the use of exhaust gases. Optional equipment includes a silencing attachment, a packsack-type



Pressure switch

Pressure switch

A new hydraulic and pneumatic pressure switch (manufactured by **Alloy Bellows Engineering Company**) operates from 0 to 1,200 psi and will withstand pressures as high as 3,000 psi without distorting its pressure element. The switch is adjustable over its entire range of pressure (from 0 to 1,200 psi) simply and without interfering with the pressure element.

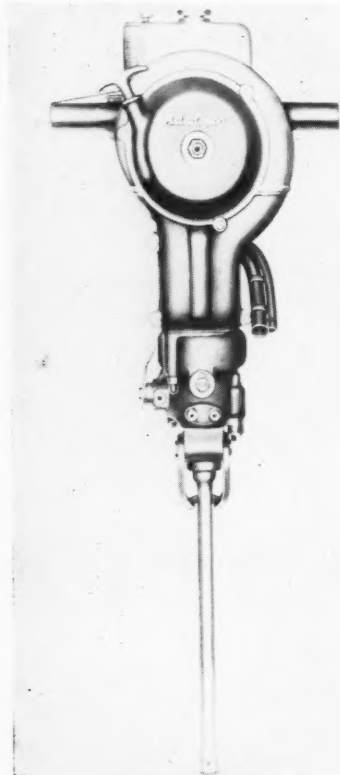
Made of cast aluminum alloy (or stainless steel) the entire unit is totally enclosed and weather-proof. It uses any microswitch (15 amp, 120 to 460 volts a-c) with single pole, double-throw silver contacts. It is also available for d-c applications. The switch can be arranged for wall or bracket mounting. (222)

Packing seal

A compact seal (BA 12A-10) for use in all types of jet water pumps, oil pumps, reduction units and appliances such as washing machines, has been introduced by **The Garlock Packing Company**. It can be used on any rotating shaft to seal any liquids that will not attack the Buna-N flexible parts or the brass metal parts.

The face of the seal is capable of withstanding high face loading and heat and is manufactured from filled true carbon to prevent porosity.

A roll designed bellows has been incorporated into the seal; this allows greater travel than the traditional V-seal bellows. The brass metal shell incorporates a rigid two-piece design in which the shell is rolled over an offset washer at the back. This imparts greater stability and strength. The static O-ring is held firmly in a groove within the seal shell. This type of ring seals higher pressure, gives a tighter fit and the seal can be mounted on a shaft from either direction.



The 53-lb. rock drill

frame (for carrying on a man's back) and the BSM-42 Atlas Copco drill steel grinder which can be powered by a flexible shaft operating off the Cobra itself. Thoroughly tested under operating conditions in many parts of the world, the new rock drill has wide application in road work, breaking, prospecting, woods operations and construction work. (221)

There is a metal back which rests against the stop, giving an exact mounting position. The seal is recommended for pressures up to 100 psi and is available for $\frac{1}{8}$ -in.- and $\frac{3}{4}$ -in.-diameter shafts, with a general operating limitation of 212F and shaft speeds up to 1,000 ft per min. The stationary seat is of a high quality ceramic, set in a Buna-N ring. (223)

Photorecording paper

A completely new, high-contrast, faster and thinner photorecording paper (identified as Lino-Writ 4) is now being sold by **Du Pont of Canada**. It is said to record higher oscillographic frequencies at faster paper travel rates than was previously possible.

The all-rag stock of the new product is 25% thinner than other photorecording papers and so permits oscillographic machines to accommodate greater footage for longer runs.

The ability of the paper to record higher frequencies (at faster paper travel rates) allows greater trace "stretch-out" and so easier data analysis. Either regular or rapid-stabilization processing methods may be used. (224)

Roller skid

The widely known and used Multiton roller skid now has a companion recently developed by **Stokvis-Edera & Co., Inc.**

The Junior (as it is called) has come as a boon to those in need of an inexpensive method with which to handle loads of from 1,000 to 6,000 lb, close to ground level.

Of all-steel construction, the new roller skid is only 2½ in. high. It moves on three 2¼-in.-diameter rollers, each equipped with precision, neoprene-sealed ball bearings. Rolling friction is thus reduced to a minimum so that capacity loads can be moved without powered equipment of any kind.

Sturdy yet light (a compact 12½ lb), this versatile dolly can be used in sets of 2, 3 or 4 to fit the load. It is available in straight-motion or swivel-type. (225)

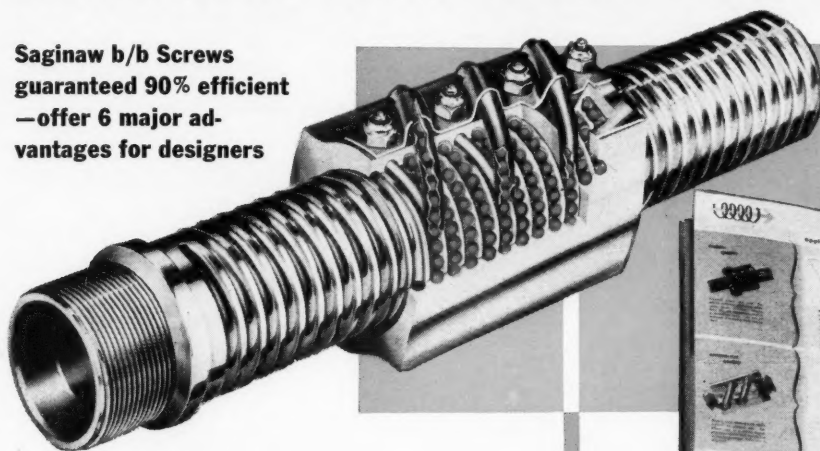
Cooling fans

A catalogue has just been published by **McLean Engineering Laboratories**, manufacturers of rack-mounted electronic cooling fans. Their full line of fans for standard 19-in. racks is illustrated and described with detailed specifications. The models cover a wide range of air deliveries and fit the popular panel heights. All the rack mounted fans are small packaged units that pressurize the cabinets with cool, filtered air and so prevent dust from entering through cracks and joints. The fans are complete in one unit and ready for use. Standard RETMA notching allows mounting on rack; no cutting or fitting is necessary. Filters are replaceable. Grilles are of stainless. (226)

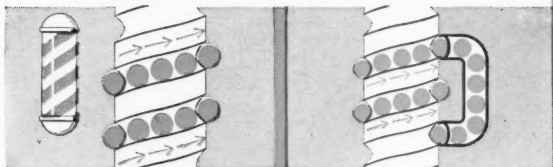
(Continued on page 70)

ACTUATION PROBLEM too tough for ordinary devices? SAGINAW CAN HELP YOU SOLVE IT!

Saginaw b/b Screws
guaranteed 90% efficient
—offer 6 major ad-
vantages for designers



Available in custom machined and commercial rolled thread types—have been built from 1½ inches to 39½ feet long—¾ to 10 inches diameter.



Nut glides on steel balls. Like stripes on a barber pole, the balls travel toward end of nut through spiral "tunnel" formed by concave threads in both screw and mating nut.

1 VITAL POWER SAVINGS. With guaranteed efficiency of 90%, Saginaw b/b Screws are up to 5 times as efficient as Acme screws, require only ⅓ as much torque. This permits much smaller motors with far less drain on the electrical system. Circuitry is greatly simplified.

2 SPACE/WEIGHT REDUCTION. Saginaw b/b Screws permit use of smaller motors and gear boxes; eliminate pumps, accumulators and piping required by hydraulics. In addition, Saginaw b/b Screws themselves are smaller and lighter. Units have been engineered from 1½ in. to 39½ ft. in length.

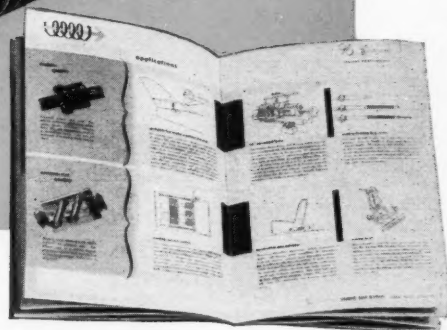
3 PRECISE POSITIONING. Machine-ground Saginaw b/b Screws offer a great advantage over hydraulics or pneumatics because a component can be positioned at a predetermined point with precision. Tolerances on position are held within .0006 in./ft. of travel.

At end of trip, one or more tubular guides lead balls diagonally back across outside of nut to starting point, forming closed circuit through which balls recirculate.

4 TEMPERATURE TOLERANCE. Normal operating range is from -75° to +275° F., but assemblies have been designed in selected materials which function efficiently as high as +900° F. These units are practical where hydraulic fluids have lost efficiency or reached their flash point.

5 LUBRICATION LATITUDE. Even if lubrication fails or cannot originally be provided because of extreme temperatures or other problems, Saginaw b/b Screws will still operate with remarkable efficiency. Saginaw units have been designed, built and qualified for operation without any lubrication.

6 FAIL-SAFE PERFORMANCE. Far less vulnerable than hydraulics. In addition, Saginaw offers three significant advantages over other makes: (1) Gothic arch grooves eliminate dirt sensitivity, increase ball life; (2) yoke deflectors and (3) multiple circuits provide added assurance against operating failure.

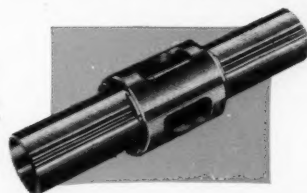


YOUR FREE COPY OF THIS NEW b/b SCREW AND SPLINE "PROBLEM SOLVER" SHOWS HOW

36 pages crammed with time-, work-, and money-saving facts: Principles • Types • Basic Operations • Coupling Methods • Efficiency • Advantages • Selection Factors • Design Data • Sample Problems

SAGINAW b/b SPLINE

● Averages 40 times lower coefficient of friction than ordinary sliding splines!



Utilizing the same basic *gliding ball* principle, Saginaw has developed the *Saginaw b/b Spline* which radically increases the efficiency of transmitting or restraining high torque loads.

It can be fitted with integral gears, clutch dogs, bearing and sprocket seats, etc. Units have been built from 3 inches to 10 feet long—¾ to 6 inches in diameter.

SEND TODAY FOR THIS FREE 1957
ENGINEERING DATA BOOK...

or see our section in Sweet's Product Design File



Saginaw
ball bearing
Screws and Splines

SAGINAW STEERING GEAR DIVISION OF GENERAL MOTORS
WORLD'S LARGEST PRODUCER OF BALL BEARING SCREWS AND SPLINES

Saginaw Steering Gear Division
General Motors Corporation
b/b Screw and Spline Operation
Dept. 7W, Saginaw, Michigan

Please send new engineering data book on Saginaw b/b Screws and Splines to:

NAME _____

COMPANY _____ TITLE _____

ADDRESS _____

CITY _____ ZONE _____ PROV. _____

New booklets and books written for you

Plastic-enclosed thermostats

Two types of **Fenwal Incorporated** thermostat units, encased in plastic for service in highly humid or corrosive environments, are described in Bulletin MC-137. These encapsulated thermostats can be immersed directly in acid or basic solutions, alcohols and aliphatic hydrocarbons, buried in soil for greenhouse or outdoor heater cable applications and exposed to highly humid atmospheres, corrosive mists or sprays.

Two types of thermostat control are offered: the standard cartridge-type and a cheaper rectangular model. Both types are available with adjusting knobs for resetting the temperature in the field or can be supplied factory-set at the control temperature. Current ratings up to 5 amps, 230 volts ac are available. (227)

Control valves

Just issued is a new bulletin LB-2 describing the **Conoflow Corporation's** complete line of Series LB control valves and giving details of construction and operating characteristics.

The valve incorporates the single-seated, split valve body design with the cylinder Conomotor actuator. The bulletin describes how this valve body and topworks combination affords greater power, higher sensitivity, faster speeds of response and less installation and maintenance costs than conventional spring and diaphragm valves. The bulletin also includes complete specifications and valve sizing data. (228)

Magnet wire

A catalogue from the Wire & Cable Division of **The Electric Auto-Lite Company** gives a handy reference table as well as electrical, physical and chemical properties of the newest enameled magnet wire, LectALite.

Tests show that this magnet wire can be used for equipment in the Class B temperature range and that it is outstanding in its resistance to Freon 12 and 22. Specifications are also shown for Class O, A, B, and H wire. (229)

Porcelain insulators

A catalogue covers all the standard wet and dry process porcelain insulators furnished by **Universal Clay Products Co.**

Included are illustrations and specifications for screw type wire holders, house

brackets, spools, split and solid knobs, tubes, cleats, antenna insulators, guy strain insulators, telephone knobs and pipe thread bushings.

In addition, the catalogue includes complete data on housings and cable supports for electric signs, as well as transformer bushing specifications. (230)

Thermocouple components

For years, users of thermocouples in every industry have been looking for a thermocouple connector which would be easy to install, easy to use, of rugged but light, heat-resistant construction and suitable for multiple connections.

Now these features are embodied in the **Honeywell Regulator Co.** Quik-Konnect components, details of which appear in brochure S 005-1. (231)

Wall chart

A comprehensive 17 x 22 in. wall chart describing brass, bronze and nickel silver casting alloys is now available from **Henning Bros. and Smith**, smelters and refiners.

For quick reference by foundry casters, engineers and designers, the chart details information on 37 standard alloys, their Navy, SAE, ASTM and Federal specification designations, and the percentage chemical composition of the ingredient metals. (232)

Polyester laminate

A comprehensive chart, which lists electrical and physical properties of eleven standard grades of fibre-glass-reinforced polyester laminate, has just been published by **The Glastic Corporation**.

The object of the chart is to help users of electrical insulation select material for their Class B temperature applications. It lists such electrical insulation properties as swelling in humidity and after heat; flexure as received, after heat and when hot; and rigidity as received and when hot. As a further help in the selection of insulation material, the chart gives common properties of phenolics for comparison. These properties have been determined by ASTM testing procedures, where applicable.

The chart is divided into three sections—one for rigid laminate grades, one for flexible laminate grades and a third for phenolics. All standard grades of Glastic laminate are described on the back of the chart. (233)

Antenna characteristics

A new 14-page handbook containing a selected group of curves of antenna characteristics has just been announced by **I-T-E Circuit Breaker Company** as an aid for engineers working with microwave antennas. (234)

Fluid system specialties

A newly issued catalogue (4395) shows **Parker Appliance Company** fluid system specialties: clips for the support of tube lines, dual heat transfer coils for cooling applications, pressure snubbers for the protection of gauges and a manifold valve to simplify draft gauge line blow out. (235)

Corrosion resistant equipment

Corrosion-resistant plastic equipment is dealt with in a new catalogue from **Haveg Industries, Inc.** The catalogue, which marks the company's twenty-fifth anniversary, gives complete coverage to a wide range of synthetic resin formulations. In addition, it describes newer products and materials: glass reinforced polyester, polyvinyl chloride and Teflon equipment.

The bulk of the catalogue details Haveg-made equipment: pipes and fittings, valves; fume ducts and fume systems; tanks, towers and accessory supplies; heat exchangers; pressure and vacuum equipment; and agitators. Data is also included on chemical-resistant cements, the field construction of plastic equipment and the firm's design service. (236)

No time like the present

LOTS OF YOU ENGINEERS have the nucleus of an article tucked away in a drawer somewhere, either in the form of rough notes or as a rough typescript.

The reason, of course, that you haven't done anything about it is because you probably feel that nobody will be interested in publishing it—so why do all the work necessary to get it in shape for nothing?

There is somebody interested in your technical article: DESIGN ENGINEERING is always on the lookout for suitable contributions. Not that we are short of material, mind you. But it does seem a pity that good stuff should not see the light of day.

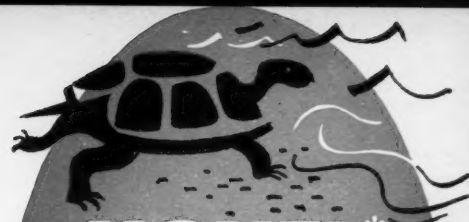
Why not act at once and tidy up that article, get it typed and submit it to DESIGN ENGINEERING? If we like it enough to publish it, you will be paid. Not a fortune, perhaps, but enough to make it worth your while.

And think of the personal satisfaction of seeing yourself in print.

IF CORROSION IS YOUR PROBLEM...
CHECK THE

MONEL

FAMILY OF STRONG TOUGH
CORROSION RESISTANT ALLOYS



MONEL*

TOUGH, RUST AND CORROSION RESISTANT

Strong, tough nickel-copper alloy that resists attack by many organic and inorganic acids, alkalis and salts. Good mechanical properties at temperatures up to 450°C. Widely used in steam plants, chemical engineering and food processing.



"R" MONEL*

EASY TO MACHINE

Freely machinable alloy with substantially the same mechanical properties and physical constants as Monel—including resistance to corrosion. Used in corrosive applications requiring extensive machining such as automatic screw machine products.



"KR" MONEL*

EASY TO MACHINE

Freely machinable alloy with substantially the same mechanical properties and physical constants as "K" Monel—including the same high resistance to corrosion. Used in applications requiring extensive machining such as grease gun fittings, bolts, nuts and valve trim.



"K" MONEL*

STRONG AND HARD

Combines excellent corrosion resistance with strength and hardness equal to many heat-treated steels. Completely non-magnetic down to -150°F. Used for pump shafts, valve parts and roller chain ... for drill collars, aeronautical instruments, anchor chain links and other non-magnetic applications.



"S" MONEL*

RESISTS ABRASION, EROSION AND WEAR

Combines the corrosion resistance of Monel with extra hardness at high temperatures and resistance to galling and seizing. Especially suitable where alignment or tight fit and resistance to corrosion, erosion, wear and abrasion are factors. Used for pistons, valve seats, bearings, pump liners, etc.

The Monel* family of corrosion-resistant alloys provides a unique combination of properties that make them suitable for a wide range of applications in many industries. These alloys are readily workable, responding to most fabricating operations in much the same way as steels of similar yield strength. Most alloys in the Monel family are available in standard forms ... and Inco Customer Service goes with them ... to help you solve metal problems. Write today for complete information.

*Trade Mark



THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED

25 King Street West, Toronto

Letters

Readers' viewpoints . . .

Electric motor design

I was very interested in C. D. Hall's article on electric motor design. The emphasis given to the number of cross-overs occurring for the four different types of winding was well merited. So was the emphasis on the insulation required between half coils in the slots of lattice windings, due to the phase-to-phase voltage occurring in such slots. Nevertheless one is left with the impression that there are no **advantages** worth mentioning in connection with lattice windings. I would not feel this comment was necessary if the paper had been titled "Insulation in Electric Motor Design."

It is very effective advertising, and certainly an advantage to the reader, to have so many of your articles backed up by well-displayed ads sponsored by companies who produce equipment described in your articles.

from A. R. Morse, Ottawa.

(Unfortunately our enquirer did not give his address, so no further action could be taken. Perhaps he would be good enough to furnish it.—ED.)

Heat-absorbent surfaces

In the January 1957 issue, page 52, an abstract of an article by A. D. Smith (Westinghouse) re heat absorbent surfaces is published.

Could you advise where a copy of the complete article is obtainable or where we could reach A. S. Smith?

from W. R. Mogridge, Chief Inspector, Plant 5, Ford Motor Company of Canada Limited, Windsor, Ont.

(We received our information from Dow Corning Corporation, Midland, Mich., and this we told our enquirer—ED.)

Whirlclad process

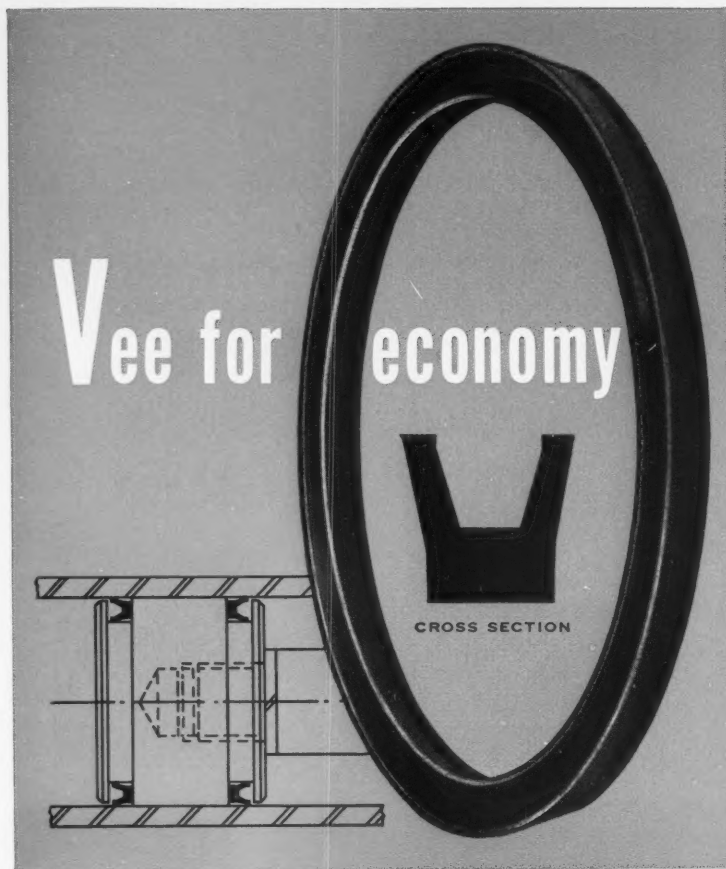
With regards to your article "Heat it, dip it and it's plastic coated" in the November issue of DESIGN ENGINEERING. I am interested in obtaining further information about the Whirlclad process. I would appreciate it if a small sample could be enclosed.

from L. A. Arsenault, 9 Price St., Kenogami, Que.

(We were not able to send a small sample but put him in touch with Polypenco Inc., who probably will—ED.)

• • •

Would you please send more information, addressed to the attention of the writer, (Continued on page 75)



SEALS BETTER, COSTS LESS, SAVES MACHINING

A single C/R Sirvene (synthetic rubber) Block Vee, in most cases, will seal as effectively as an entire stack of ordinary multiple vees. Assembled in the groove of a hydraulic piston, the Block Vee will permit the use of larger tolerances, but will not roll or twist like an O-ring. The double-angled lip provides greater flexibility with lower friction and longer service life. Under pressure both lips are loaded to form an effective seal up to 5000 psi. Perhaps this part will help you design for lower cost. Ask a C/R Sirvene engineer.



CHICAGO RAWHIDE MFG. CO. OF CANADA LIMITED

508 WELLINGTON ST. N. • HAMILTON, ONTARIO

A DIVISION OF SUPER OIL SEAL MFG. CO., LIMITED

Other C/R Products

OIL SEALS: Shaft and end face seals for all types of lubricant retention and dirt exclusion • Rawhide hammers and mallets

Bendix-Pacific ELECTRO-SPAN

GIVES YOU THE MOST VERSATILE TANK GAUGING SYSTEM

Programmer



Prints time and date prior to each liquid level gauging.

Calendar/Clock



Automatic digital read-out of minute, hour, day, month and year.

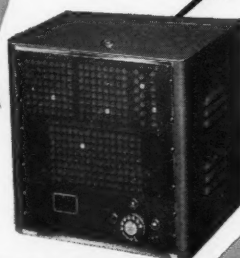
Card Punch



Permanent record of selected gauging for automatic data processing equipment.

Remote Tank Selector

Single Wire Pair



Indicating Receiver/Control

Auto Sequential Scanner



All or selected tanks are read in sequence automatically.

Cycle Timer



Orders the read-out of tanks at pre-set time or time intervals.

Electric Typewriter



Provides easily read, permanent log of all (or selected) gaugings.

With Electro-Span Gauging Systems you can secure any arrangement of a basic system—together with a unique selection of input and readout equipment—to meet virtually every requirement.

The Electro-Span System is an inexpensive digital pulse-code system for the measurement

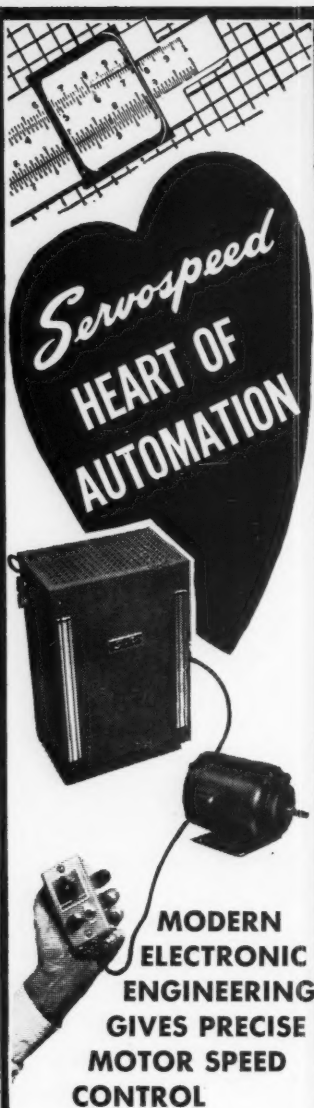
and control of any number of tanks. Tank levels to $\frac{1}{8}$ ", and averaging temperatures if desired, are displayed on lamp registers.

In addition, all of the important accessories shown above can be provided to give you the most complete tank gauging system available today.



COMPUTING DEVICES OF CANADA LIMITED

P.O. BOX 508 • OTTAWA • CANADA



Servospeed
HEART OF
AUTOMATION

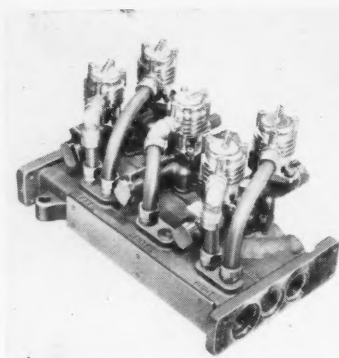
**MODERN
ELECTRONIC
ENGINEERING
GIVES PRECISE
MOTOR SPEED
CONTROL**

Modern industrial electronic engineering has been coordinated with electric motor design to provide a versatile means for obtaining the full possible advantage of speed control in DC motors while operated from the regular alternating current power line. Grid controlled "Thyratron" tubes are utilized for power controlled stepless variation to supply motor armature power. Patented feedback, or "Servo" circuits provide constant torque capability over wide speed ranges of as high as 60 to 1 in some models and a minimum of 20 to 1 in others.

Servospeed
DIV. of ELECTRO DEVICES, Inc.
4 Godwin Ave., Paterson, N. J.
ARMory 4-8989

New products

Continued



Aluminum manifold

Designed to afford economical and efficient multiple mounting of Speed King 2-, 3- or 4-way valves in any desired combination, is the new manifold announced by **Valvair Corporation**.

Available in 2- and 3-station types, the new cast aluminum manifold has full length inlet and exhaust ports (both 1 in. NPT) common to all valve stations. Electrical wiring is run through a 1/4-in. NPT conduit passage, with one access cover for all stations to simplify wiring. Pilot solenoid leads are enclosed in dirt-proof and moisture-proof flexible conduit. The manifolds are designed with side or bottom cylinder porting to facilitate piping. Holes for mounting the manifold and valve assembly are also provided.

According to the manufacturer, the new manifold can be adapted to any type of control valve application. Combinations of single or double solenoid Speed King valves can be mounted at any station on the manifold. 2-, 3- and 4-way valves can be used in any combination. Remote operated, speed-controlled and oil-pilot Speed King valves also are suitable for installation. (237)

Hole puncher

Announcement has just been made of a new line of Series G hole-punching units by **Punch Products Corporation**, manufacturers of unitized hole-punching and notching equipment.

These units are completely self-contained and no parts are attached to the press ram. The punch and die are held in perfect concentricity by a rugged meehanite holder. They are designed for close centre-to-centre hole locations in angles, channels, extrusions, sheets and strips.

A special slot in the bottom of the holder fits on to the press brake bed rail and permits quick, easy gang punching setups ready to produce parts in

a matter of minutes. The simplicity of setup with a group of the units allows rapid change of individual hole locations as well as entire hole-punching patterns.

Inexpensive, interchangeable die buttons fit into the die adapter for punching various diameter holes. The economical punches are easily and quickly interchanged to correspond with the die diameters. The extra long stripping guide, combined with the long guide hole in the holder, increases the life of both units and operating parts.

The narrow stripping assembly consists of two long-life, heavy-duty springs for close centre-to-centre perforating.

(238)

Spring tension fasteners

One of the world's largest aircraft companies has recently adopted a specially engineered Tinnerman Speed Nut (**Dominion Fasteners Ltd.**) for retaining aluminum templates used for making plaster molds and mock-ups.

The templates are made of aluminum sheet, shaped or curved for a particular station. To prepare plaster model sections, some four or six threaded template rods (8 to 12 ft long) are inserted in the template. The nuts are then merely slipped onto the rods and tightened to hold the templates securely in place. After all templates have been properly positioned, the entire unit is filled with plaster of Paris to form a contour which becomes the master template for aircraft dies, jigs and fixtures.

Formerly, square nuts had to be threaded up the long template rods, a costly and time-consuming hand operation. The special fastener, however, is designed with an opening on one side which permits it to be placed on the template rod at any point and tightened against the aluminum panel with one or two turns. (239)

Epoxy resins

A technical bulletin (No. 10), recently published by **Smooth-On Manufacturing Company**, contains a complete description of the techniques involved in using epoxy resin compounds for casting. This information is of value to those employing epoxies for making models or patterns, vacuum-forming molds, dies, jigs and fixtures, and potting or encapsulation of electrical and electronic components.

Discussed are Metalset and Sonite epoxies, but the same information generally applies to the handling of all epoxy resin casting compounds. The bulletin covers the general handling characteristics of epoxies for casting the special handling required with wood, plaster and plastic molds, and with flexible molds. The important aspects involved in the curing of these cast epoxies are discussed in detail with regard to both small and large castings and including the times and temperatures involved. (240)

POLYTHENE

accelerates
technical
progress

in electronics

these polythene television circuit components are without equal where low dielectric loss at high frequencies is of prime importance.

in chemicals

this polythene metering wheel measures highly corrosive concentrations of hydro-fluoric acid. Polythene is easy to fabricate and highly resistant to chemical attack.

in air conditioning

air filters packed with shredded polythene develop a high electrostatic charge, collect dust and dirt, yet wash clean quickly and easily. These filters are used in the new air conditioning system of the Sheraton-Mount Royal Hotel.

Designers in all fields!

UTILIZE POLYTHENE'S SPECIAL PROPERTIES! it's light, tough, non-toxic, chemically inert; has exceptional dielectric characteristics, remains flexible and strong even at sub-zero temperatures.

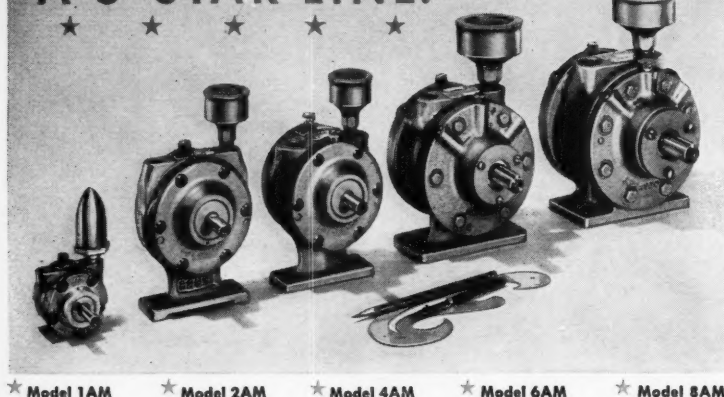
for further information and technical service, write:

C-I-L Plastics Division,
P.O. Box 10, Montreal,
suppliers of polythene
resin to converters



POLYTHENE

A 5-STAR LINE!



GAST rotary-vane AIR MOTORS

offer explosion-proof, variable-speed power that's surprisingly compact!

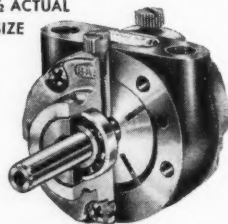
Here's the complete 5-star line of Gast rotary-vane Air Motors . . . offering ten unique advantages on products or applications located near a compressed air source:

1. Explosion-proof power in explosive or inflammable atmospheres. No sparks, no danger!
2. Low initial cost compared to other motors.
3. Variable in speed with simple valve control.
4. Can't burn out if overloaded or stalled.
5. Reversible rotation optional on 4AM and 8AM.
6. Rotor vanes take up their own wear.
7. Quickly attached to plant air lines.
8. Amazingly compact and light for h.p. delivered.
9. Ball-bearing; almost service-free design.
10. Mechanically simple, neat in appearance.

As original equipment, Gast Air Motors are driving pneumatic hoists, mixers for paint and chemicals, fans, blowers, fuel hose-reel rewinders, liquid pumps, thread spooling machines and many other products. Right or left rotation available. Housings available with or without foot on most models.

GAST MANUFACTURING CORP.,
in Canada GRISWOLD & CO. LTD.,
146-D Bates Road, Montreal 8, Quebec.

MODEL 1 AM
½ ACTUAL
SIZE



Note the simple principle and trouble-free construction.

PERFORMANCE TABLE				
Model No.	R.P.M.	HORSE POWER		Wt. Lbs.
		at 60 P.S.I.	at 90 P.S.I.	
1 AM	2,000 5,000	0.11 0.21	0.13 0.30	1½
2 AM	1,000 2,000	0.22 0.40	0.35 0.57	5¼
4 AM	1,000 2,000	0.48 0.78	0.73 1.10	7½
6 AM	500 2,000	0.40 1.30	0.65 2.00	18
8 AM	500 1,500	1.00 2.30	1.45 3.80	25

For complete performance data, write for Bulletins! Specify models that interest you.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY

- AIR MOTORS TO 4 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

SEE OUR CATALOG IN SWEET'S PRODUCT DESIGN FILE

Society Column

Standards Engineering Society:

The newly formed (September 1956) Hamilton-Toronto Chapter held a dinner meeting at Fischer's Hotel (Hamilton) on January 24 under the chairmanship of M. J. McKerrow of Canadian Westinghouse.

Speaker for the occasion: A. S. Harrison, Director of Purchasing, Ford Motor Co. of Canada Limited. His subject: Modern Purchasing and Its Effect on Standardization.

The Society is growing and already has 32 members. The next meeting is on March 28 at the same place.

American Society of Metals:

The Ontario Chapter held a meeting on February 1. The speaker was Samuel Epstein, Technical Adviser, Research Department, Bethlehem Steel Company on the subject of ageing and embrittlement of mild steel.

Ladies' Night (dinner, dancing and entertainment) will be held in the King Edward Hotel, Toronto, on March 1.

National Association of Corrosion Engineers:

The first all-Canadian technical committee in the NACE has been formed under the chairmanship of C. L. Roach, Bell Telephone Company of Canada.

The Chemical Institute of Canada:

A dinner meeting was held on February 5 in the Empress Room at the Park Plaza Hotel, Toronto. The speaker was Professor F. A. Forward of the University of British Columbia who spoke on the subject of extractive metallurgy.

The American Materials Handling Society:

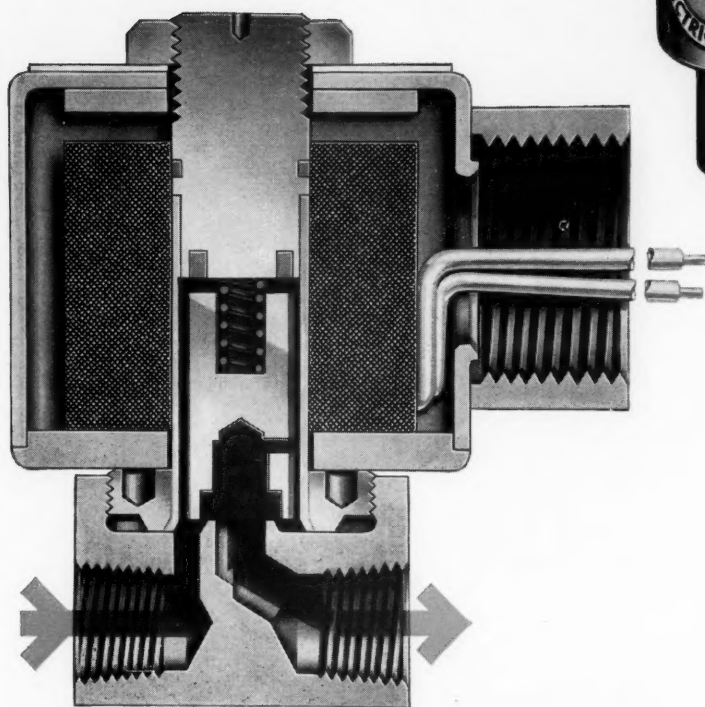
Sponsored by the Montreal Chapter, the first Canadian National Materials Handling Show and Conference will be staged at the Show Mart, Montreal, September 30 to October 4.

The Society of the Plastics Industry (Canada) Inc.:

The 1957 conference is scheduled for April 4 and 5 in Ottawa. It will be chaired by Eric G. Salmond and will bring together some 250 leaders of the Canadian, U. S. and foreign plastics industry for technical and other discussions.

Association of Professional Engineers

More than a thousand members gathered at the Royal York Hotel on January 26 and were lucky enough to hear a luncheon address by Brig. C. D. Quilliam (British Army retired) of Kingston, Ont. His most interesting discourse dealt with root causes of the Middle East situation.



actual size

New C-series solenoid valve offers recognized "Skinner Quality" at low cost

This is a faithful reproduction—in miniature—of the time-tested, 2-way, normally closed Skinner V5 except that the body is made of brass.

This new, compact Skinner valve weighs only 12 ounces, yet it's rugged enough to last millions of cycles on most applications.

This new valve has orifices from 5/32" to 7/64", with pressures ranging from 60 to 130 psi. Pipe size is 1/8" NPT. It is a packless, direct-acting valve with only two moving parts. And it's absolutely bubbletight—even on vacuum. This C-Series Skinner valve is fail-proof, too—a built-in spring return assures positive closing; thus it can be mounted in any position and is

ideal for direct-line mounting.

You'll find this new valve, with its recognized "Skinner Quality," the perfect low-cost answer to a wide range of flow control problems. It works efficiently with air, water, oils, gasoline and many other media. Typical applications include: automotive fuel systems, welding equipment, vending machines, lubricating devices, spraying equipment, air horns, water softeners, humidifiers and instrumentation.

Our Bulletin D11.1 contains complete information on this valve—flow curves, optional features, dimensions, electrical data, etc. We will be happy to send you a copy on request.



SKINNER ELECTRIC VALVE
DIVISION NEW BRITAIN
CONNECTICUT
THE SKINNER CHUCK COMPANY

56-579

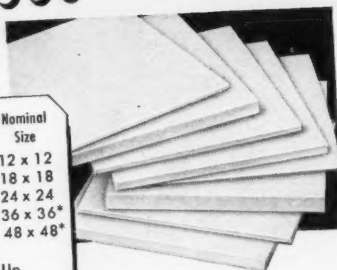
Teflon...*

Your Best
Source Is

JOHN CRANE

Thickness Inches	Nominal Size
1/16	12 x 12
3/32	18 x 18
1/8	24 x 24
3/16	36 x 36*
1/4	48 x 48*
3/8	
1/2 & Up	

* Can be furnished
in 1/2 sheets



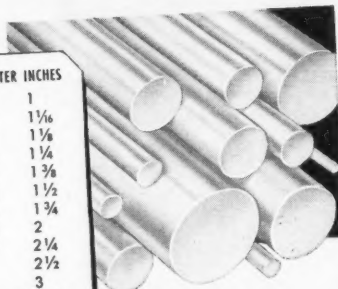
SHEET

HERE'S WHY: You can order in quantity and in a wide variety of sizes—and be certain of complete uniformity throughout. Our strict density control assures you thoroughly non-porous Teflon—free from any flaws which might possibly affect your end use or product. Dimensions are accurate to your most critical tolerances—no rejects, waste of material or loss of time. You get product purity—Teflon at its best in every one of its remarkable characteristics. Delivery is prompt—you get the quantity you want when you want it.

Since the availability of Teflon, "John Crane" engineers have worked with Industry to successfully solve innumerable problems and develop new applications. *You can benefit from their experience and know-how.*

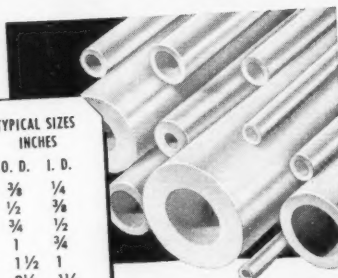
DIAMETER INCHES
1/4
3/8
1/2
3/4
1
1 1/4
1 1/2
2
2 1/4
2 1/2
3

Other diameters
on specification



ROD

TYPICAL SIZES INCHES	
O. D.	I. D.
3/4	1/4
1/2	3/8
3/4	1/2
1	3/4
1 1/2	1
2 1/2	1 1/2
3	1 3/4



TUBING

Characteristics of Teflon

- CHEMICAL**
Completely inert.
- ELECTRICAL**
Very high dielectric strength.
Extremely low power factor.
- THERMAL**
Temperature range
-300° to +500° F.
- MECHANICAL**
Strong, flexible, weather
resistant.
- LOW COEFFICIENT OF FRICTION**
Absolutely non-stick.

* DuPont Trademark

Request full information and ask for our bulletin, The Best in Teflon. Crane Packing Company, Ltd., 631 Parkdale Avenue, North, Hamilton, Ontario.



CRANE PACKING COMPANY



Infrared materials

(Continued from page 36)

design of the system adjusted to suit.

Infrared optical materials may be classified according to physical structure into two types—crystals and glasses. Most commercially available infrared optical materials are single crystals of chemical compounds. Many of these crystals have good infrared transmission and are moderately priced. Of all those available, however, only sapphire has particularly desirable chemical and physical properties. It has transmission only to about 6 microns and sizes currently available are limited to 2.5 in. diameter. All crystals are limited in size by inherent limitations in the crystal growing process, although some are available in boule sizes up to 7.5 in. diameter. Many crystals are hygroscopic or otherwise subject to chemical attack or atmospheric corrosion; sodium chloride and potassium bromide are examples. Some crystals (like lithium fluoride and calcium fluoride) are easily cleaved and consequently mechanically weak. All crystals require special fabrication techniques and some, including KRS-5 and silver chloride (see fig. 5, 3 and 4) are particularly difficult to form into precise, stable optical elements. Crystals such as KRS-5 and KRS-6 are quite toxic and special precautions must be taken in handling and fabrication. KRS-5 and silver chloride are subject to cold flow under pressure and may undergo change in the optical figure over a period of time.

Glasses are usually preferable to crystals for infrared optical use because of the ease of fabrication, uniformity of optical properties and comparative lack of size limitations. Three general types of glass are available commercially for infrared use. Silicate optical glasses are useful to about 2.5 microns, fused quartz is useful to about 4 microns (see fig. 5) and arsenic trisulfide glass (manufactured by Servo Corporation of America under its trademark, Servofrax (see fig. 6) is useful for most applications to 12 microns. Investigation is currently in progress to develop glasses to be used in conjunction with Servofrax for the manufacture of infrared achromatic lenses.

Ordinary optical glasses and fused quartz are generally more satisfactory where their limited transmissions allow them to be used. Fused quartz, in particular, has superior physical strength, chemical stability and resistance to thermal shock. These materials, also, are the least expensive of the infrared optical materials, both in basic material cost and in cost of fabrication.

Although less desirable from the standpoint of physical and thermal properties, arsenic trisulfide glass will transmit to longer wavelengths, a useful property. ★

Letters

(Continued from page 68)

on the new process licensed exclusively by Polymer Processes Inc. as outlined on Sheet 37 of the November issue of DESIGN ENGINEERING, copy of which is enclosed.

from T. E. Harris, Mechanical Engineering, Power Crane & Shovel Division, Dominion Engineering Company Ltd., Montreal.

• • •

In the November issue of Design Engineering reference is made to a new plastic-coating process which will be known in Canada under the trademark Whirlclad.

Polymer Processes Inc. has been licensed and we would appreciate your advising their address so that we might contact them for additional information. from J. L. McClellan, purchasing agent, the International Nickel Company of Canada, Ltd., Copper Cliff, Ont.

(Here is the Whirlclad process again, so we put them in touch with Polypenco Inc.—ED.)

Scale models

Referring to the article printed in your magazine of December 1956 on the 3-D Model Arcotec kit, we are interested in obtaining additional information such as: supplier's name and address, price of kit, more literature if available.

from W. Chainey, Plant Engineering Department, Aluminum Company of Canada, Ltd., Arvida, Quebec.

Also from J. Josephson, B.Eng., J. Pollock-Josephson & Associates, P.O. Box 232, Montreal 8.

(The address is: Arcotec Ltd., 2747 Cochrane Rd., Calgary, Alberta—ED.)

Technical film index

Will you please find attached completed questionnaire in connection with your survey.

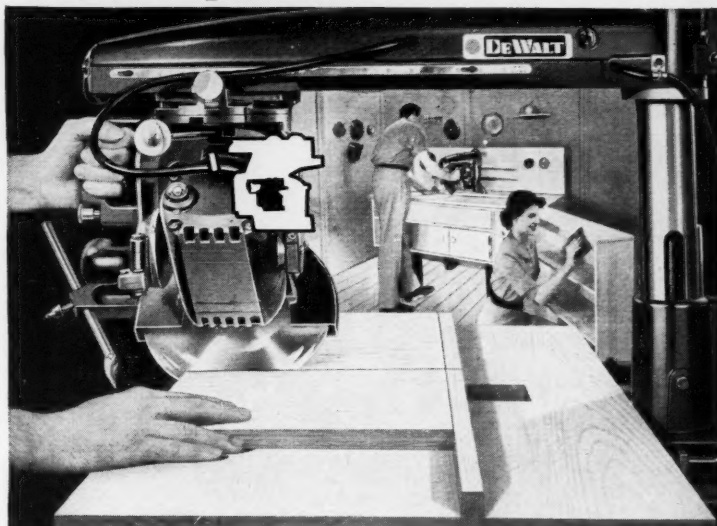
There is a service which will be appreciated by this Society and which you may be interested to consider. Our activities consist of film shows, plant visits and technical meetings; films actually provide the basis of our program. Accordingly it is of considerable interest to us to have a comprehensive technical film index and, equally important, to keep this up to date on new film issues.

There may be a number of groups such as this to whom such a service would be very valuable. I suggest this receive consideration as a regular feature of Design Engineering.

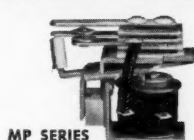
from D. Young, Chairman, Owen Sound technical and educational society, 345 18th Street West, Owen Sound, Ont.

(We are looking into this matter but in the meantime would appreciate reader reaction to the idea. Any suggestions?—ED.)

Potter & Brumfield engineering is in this picture



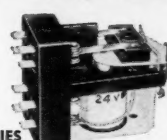
Which P&B relay would you specify for this HIGH STARTING TORQUE MOTOR?



MP SERIES



MS SERIES



AB SERIES

Radial Saws by DeWalt, Inc. are used in thousands of home work shops, in lumber yards, carpenter shops and industry. The electric motors that operate these saws are a heavy duty single phase, AC, modern capacitor, voltage relay type. They have a **high starting torque** in order to quickly achieve operating speed, even when heavy line loads give lower voltage than normal. To avoid arcing and burning during initial current surge, DeWalt needed a positive, fast acting relay that would remain in contact until operating speed was reached.

Their choice? P&B MP series relays! These sturdy relays not only save arcing and burning during initial current surge, but are compact, rugged and dependable. Their versatility permits use with any capacitor type motor up to 2 horsepower. They can be furnished with an alnico magnet if whole snap action is needed.

This ready solution to DeWalt's relay problem is an example of how P&B relay engineering is daily adapting existing relay types to specific needs. P&B's unique 25 years of relay engineering experience provides an immense reservoir of skill, information and technical ability that can help solve your relay problems faster and more efficiently.

P&B Representatives in Canada: Aeromotive Engineering Products, Montreal
A.T.R. Armstrong, Ltd., Toronto • Charles L. Thompson, Ltd., North Vancouver

Potter & Brumfield, inc.

PRINCETON, INDIANA Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

Manufacturing Divisions also in Franklin, Ky. and Laconia, N. H.

ENGINEERING DATA

SERIES: MP. Small general purpose power relay.

CONTACTS: 1/2" fine silver rated 25 amp., 115 V. AC non-inductive load, or 2 HP, 115 V. AC.

CONTACT ARRANGEMENTS: SPST NO, SPST NC, SPDT.

VOLTAGE RANGE: DC: Up to 220 V. AC: Up to 230 V.

COIL RESISTANCE: 15,000 ohm maximum.

TEMPERATURE RANGE: DC: -55° C. to +85° C. AC: -55° C. to +55° C.

TERMINALS: Standard pierced solder lug holes will take No. 10 hook-up wire.

ENCLOSURES: Dust cover, 2-59/64" L x 2 1/4" W. x 2-3/32" H. Hermetically sealed cover dimensions same as above.

DIMENSIONS: Maximum 2 1/4" L x 1 1/4" W. x 1 1/4" H.

This relay will normally deliver a minimum of 300,000 operations before wear will warrant readjustment.



IS YOUR INDUSTRY KEEPING UP WITH THE FAST-MOVING HEAT-CONTROL FIELD?

DO YOU KNOW ABOUT FENWAL'S MINIATURE AND MIDGET THERMOSWITCH® TEMPERATURE CONTROLS?

DO YOU KNOW THAT THE UNIQUE THERMO-SWITCH PRINCIPLE MAKES FOR THE MOST RUGGED, RELIABLE THERMOSTATS?

DO YOU KNOW THAT FENWAL NOW MAKES EXTRAORDINARILY SMALL ONES FOR TIGHT SPOTS?

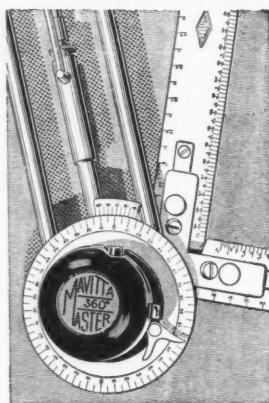
Designers — write Fenwal Inc., Factory Representative, Rousseau Controls, Ltd., 640 Decourcelle St., Montreal 30, P. Q., Canada.



**Controls Temperature
... Precisely**

MAVITTA DRAFTING MACHINES

A complete range of Drafting Machines for Boards up to 50 feet long, both vertical and horizontal.
Adjustable Drawing Stands and Boards.
Mathematical Scales in various materials.
Surveyor's Rods.
Isometric Projection Machines.



THE MASTER—latest in our range—Linkage by steel bands and pulleys—360 degrees rotation of index head—automatic location of main angles by press button through knob—quick release of head for lining up to drawings—counter balanced for vertical use—modern styling and high quality finish.

FULL CATALOGUE ON APPLICATION

The MAVITTA DRAFTING MACHINES LTD.
HIGHLANDS ROAD • SHIRLEY • BIRMINGHAM
Phone: SOLIHULL/2231/2. Grams: Mavitta, B'ham

M1

NEXT MONTH IN DESIGN ENGINEERING

APRIL

X-Weld — process for increasing weld area of heavy duty drains.

Kanigan Coating — uniform, hard, corrosion-resistant coating.

Vickers Vanguard — details of aircraft to be delivered to TCA, 1960.

Pressure Measuring Instruments — present limitations and basic design principals for instruments of higher accuracy.

High Strength Bolts — high tensile bolts for structural joints.

Bifocal Lenses — general information on design and manufacture.

Ceramettalic Materials — friction materials of ceramic and metal.

Aluminum Bronze Castings — a new aluminum bronze with better casting properties and mechanical strength.

PLUS — more than 10 departmental pages

ADVERTISING DEADLINE — MARCH 15TH



WHICH SET SCREW IS THE BRISTOL?

At a glance the two set screws look alike. But identical twins can have very different characters. The extra built-in quality of Bristol screws may not show on the surface, but it does show in longer life, better performance and greater product acceptance. All Bristol screw products are manufactured from specially selected alloy steel, expertly heat-treated, accurately machined to closer tolerances and inspected with painstaking care. The result is perfect fit that speeds assembly and won't work loose. Write our Socket Screw Division for information.

P.S. The Bristol Screw is on the top.



Precision Socket Screw Manufacturers Since 1913

THE BRISTOL COMPANY OF CANADA LIMITED
TORONTO HAMILTON MONTREAL VANCOUVER

\$400. SAVED with **DEXION** SLOTTED ANGLES



Using Dexion slotted angle, a leading Hamilton printing plant built this surface table for approximately half the cost of a ready-made unit. Dexion is sure to save time, labour and money in your plant, too.

Full details from
DEXION (CANADA) LIMITED,
114 Clayson Road, Weston, Toronto 15.

With the machine you design-

When the machine you design goes into practical service it will likely operate in conjunction with auxiliary equipment. The dependability and efficiency of such units will have a definite effect upon your machine — for better or for worse.

Experienced design engineers specify KENNEDY-FALK geared equipment and Falk Steelflex Couplings.

Consult Kennedy engineers wherever and whenever Speed Reducers, Motoreducers, Shaft Mounted Drives and Couplings are applicable. Ask for descriptive bulletins.



THE WILLIAM KENNEDY & SONS LIMITED

A DIVISION OF MILLSPAUGH LIMITED, SHEFFIELD, ENGLAND

OWEN SOUND, ONTARIO

MONTREAL: 1224 St. Catherine St. W. • ST. CATHARINES: 50 Church Street • HAILEYBURY: John H. Brumell





Actual overall
length horizontal
models:
3½", 5", 6".

**"ADJUSTABLE
STROKE"
MIDGET
Air-Clamp
CYLINDER**

Now—put pressure where it's wanted instantly and cheaply, with Mead's powerful new midget air cylinders (1" bore, single-acting, spring return—horizontal and vertical). Stroke is adjustable. Cut costs—use 'em singly or in groups to move, hold, press or eject small work pieces; to close and open large jigs, forms, fixtures. They'll replace human fingers and mechanical clamps in countless routine jobs. *Catalog Free!* Write for fact-and-picture packed Air Power Catalog — or ask your nearest Mead Man!

MEAD SPECIALTIES COMPANY

Write to stocking distributors:

J. B. MORRISON MACH. CO. LTD.
45 Oriole Parkway, Dept. D-37
Toronto, Ont.

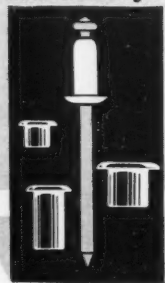
L. S. TARSHIS & SONS LTD.
450 McGill St., Dept. D-37
Montreal, Que.

**EYELETS
AND
"POP"
RIVETS**

USMC Standardized Eyelets reinforce as well as fasten—they're easy, fast and economical to apply.

"POP" Rivets handle blind spots and open sections—can be driven at rate of 1200 per hour.

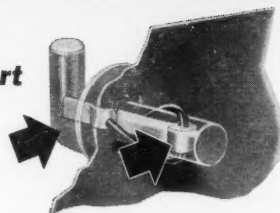
Write for catalogues.



USMC

**UNITED SHOE MACHINERY COMPANY
OF CANADA LIMITED
MONTREAL • TORONTO • GALT • QUEBEC**

**Use the
shelf support
that has
both!**



**PLASTIC for design...
STEEL for strength...**

A steel insert, molded into plastic Spring-Lock shelf supports, gives strength where it's needed—at the point of load or impact—eliminates doubts concerning the strength of plastic or undesirable cold flow.

The design flexibility of Spring-Lock shelf supports may be applied to a variety of uses...washer cover knobs, drawer pulls and others. Spring-Locks cut material and assembly costs, too. No special tools, bolts, nuts or threadings needed. Just a half-turn locks them securely; another half-turn provides for removal. Write for 40-page catalog and samples.

SIMMONS FASTENERS

Quick-Lock • Spring-Lock • Roto-Lock • Link-Lock • Dual-Lock

SIMMONS FASTENER CORPORATION

1776 North Broadway, Albany 1, N. Y.

**in designing and in
the maintenance of
industrial machinery
more and more
engineers specify**

TECALEMIT

**automatic
lubricating equipment
to ensure
trouble-free
operation
through
efficient lubrication**



Head office and plant: Rexdale Blvd., Rexdale, Ontario

Cable: Tecalemit, Toronto Tel. CH. 4-1126

world's widest range of specialized lubricating equipment

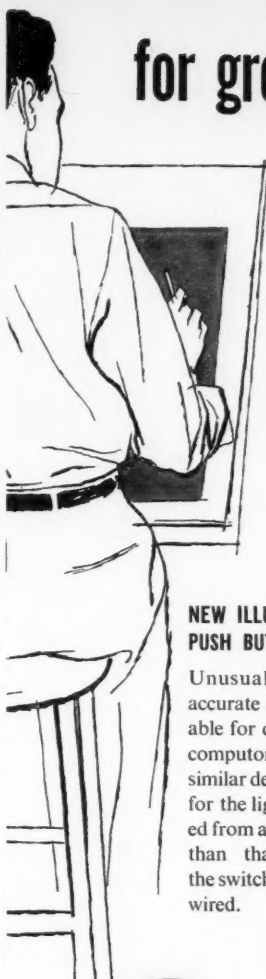
Advertising index — March

A	
101 Aeroquip Canada Ltd.	25
102 Alloy Metal Sales Ltd.	63
103 Aluminum Co. of Canada Ltd.	Inside Front Cover
104 Atlas Steels Ltd.	17
B	
105 Bach Simpson Ltd.	14
106 Bellows Pneumatic Devices	8
107 Bristol Co. of Canada	77
C	
108 Canada Illinois Tools Ltd.	22
109 Canada Iron Foundries Ltd.	15
110 Canadian Allis Chalmers Ltd.	20
111 Canadian General Electric Co.	24
112 Canadian Industries Ltd.	71
113 Canadian Vickers Ltd.	26
114 Canadian Westinghouse Ltd.	7
115 Computing Devices of Canada Ltd.	69
116 Crane Packing Company	74
D	
117 Dexion (Canada) Ltd.	77
118 Dominion Fasteners Ltd.	13
119 Dominion Rubber Co. Ltd.	21
E	
120 Eagle Pencil Co. of Canada Ltd.	2
121 Esco Ltd. of Canada	6
F	
122 Fenwal Inc.	76
G	
123 Gast Manufacturing Corp.	72
124 Glidden Paint Co. Ltd.	61
125 Goodrich Canada Ltd. B.F.	9
H	
126 Heim Co., The	16
127 Honeywell Controls Co. Ltd. (Micro Switch)	79
I	
128 International Nickel Co. of Canada Ltd.	67
K	
129 Kennedy & Sons Ltd., The Wm.	77
M	
130 Mavitto Drafting Machines Ltd.	76
131 Mead Specialties Co.	78
132 Minnesota Mining & Mfg. of Canada Ltd.	30
N	
133 National Vulcanized Fibre Co.	59
134 Noranda Copper & Brass Ltd.	57
O	
135 Ohmite Mfg. Co.	19
P	
136 Parker Rust Proof Co. of Canada Ltd.	12
137 Polymer Corp. Ltd.	4
138 Potter & Brumfield Mfg. Co. Inc.	75
R	
139 Reichhold Chemicals (Canada) Ltd.	18
S	
140 Saginaw Steering Gear Corp. General Motors Corp.	65
141 Servo-Speed Inc.	70
142 Simmons Fasteners Corp.	78
143 Skinner Electric Valve	73
144 Standard-Modern Tool Co. Ltd. (Mfg. Div.)	11
145 Standard Tube & T.I. Ltd.	23
146 Super Oil Seal Mfg.	68
T	
147 Tecalemit (Canada) Limited	78
148 Timken Roller Bearing Co., The	Outside Back Cover
149 Torrington Co.	55
150 Torrington Mfg. Co. of Canada Ltd.	28
U	
151 United Shoe Machinery Co. of Canada Ltd.	78
152 Union Carbide Canada Ltd.	Inside Back Cover
V	
153 Victor Mfg. & Gasket Co.	10
W	
154 Wagner Electric, Div. of Sangamo Co.	27

for greater design freedom

MICRO SWITCH

*offers a complete line
of precision switches*



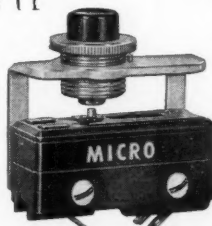
NEW ILLUMINATED PUSH BUTTON SWITCH

Unusually precise, accurate and dependable for operation on computers and other similar devices. Power for the light is obtained from a circuit other than that to which the switching units are wired.



PUSH BUTTON ACTUATORS

These switches combine long life, reliable operation, smart appearance and good feel. For industrial devices which require reliable panel-mounted, manually-operated switches.



PANEL MOUNTING PUSH BUTTON SWITCH

This subminiature switch provides almost simultaneous switching with a snap-acting mechanism that gives a positive feel. One of a complete line of panel mounting Push Button Switches designed for any application.



For name of nearest distributor and/or Micro Switch Catalogue 75B, write Honeywell, Dept. 502, Toronto 17, Ont.



MICRO SWITCH

A DIVISION OF HONEYWELL CONTROLS LIMITED, TORONTO 17, ONTARIO

Editorial

The Shortage of Metallurgists

There is no doubt that the design engineer owes a big debt to the metallurgist. Without the advances that have been made in materials, it is not too much to state that many present-day designs would still be just dreams.

Take, for example, the jet engine. Basically simple in principle, Whittle was able to make a practical proposition of it only because suitable heat-resistant alloys had been developed.

The shortage of metallurgists in Canada is most serious. Without them, the design engineer is bound to be handicapped. In fact, the only way to get the best results in design is for the two to work side-by-side.

It is most gratifying, therefore, to know that great efforts are being made by the Ontario Chapter of the American Society for Metals (under the chairmanship of T. G. Bradbury) to foster interest in metallurgy as a career. At a recent Toronto meeting (co-sponsored by the ASM and the Metallurgy Department of the University of Toronto), a large audience of science teachers was at the receiving end of an address by Dr. Convey (head of the Bureau of Mines) who had some interesting things to say about the "iums" (titanium and uranium) and metal whiskers.

Dr. L. M. Pidgeon, who next addressed the meeting, made the significant statement that, out of 730 freshmen at the U of T this year, only 15 chose metallurgy, probably because other branches of engineering have sold themselves better to the students.

Courses in metallurgical engineering are available at the following universities: Toronto, Queen's, McMaster, McGill, Ecole Polytechnique, Laval and UBC.

A free service to readers

As a further service to our readers, it is proposed in forthcoming issues to devote space to *Situations Vacant* and *Situations Wanted* in the field of product design throughout Canada.

For individual engineers who want to change their position, this service will be *free of charge*. A box number will be provided to make sure that the listing is confidential.

For companies wishing to advertise positions vacant, the classified advertising charge will be 5 cents a word (or figure) with a minimum charge of \$5 per insertion. Larger space will be charged according to the current advertising rate card, available upon request.

Applications should be addressed to the editor.

William Morse .

help yourself . . . it's free

Instead of writing to a dozen different
manufacturers to get information and literature
about products mentioned in **DESIGN ENGINEERING**
just circle the numbers on the other
side of the card below . . . complete and mail . . .
We contact the manufacturer for you and pay all
postage. Go on . . . help yourself ►

BUSINESS REPLY POST CARD
No postage necessary if mailed in Canada


5c postage will be paid by

Design Engineering

P. O. Box 100

Toronto, Ontario



circle items below ...
complete and mail ...
free information on the
newest products 

Advertisement key numbers

101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122
123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144
145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166
167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188

New products and literature

200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221
222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243

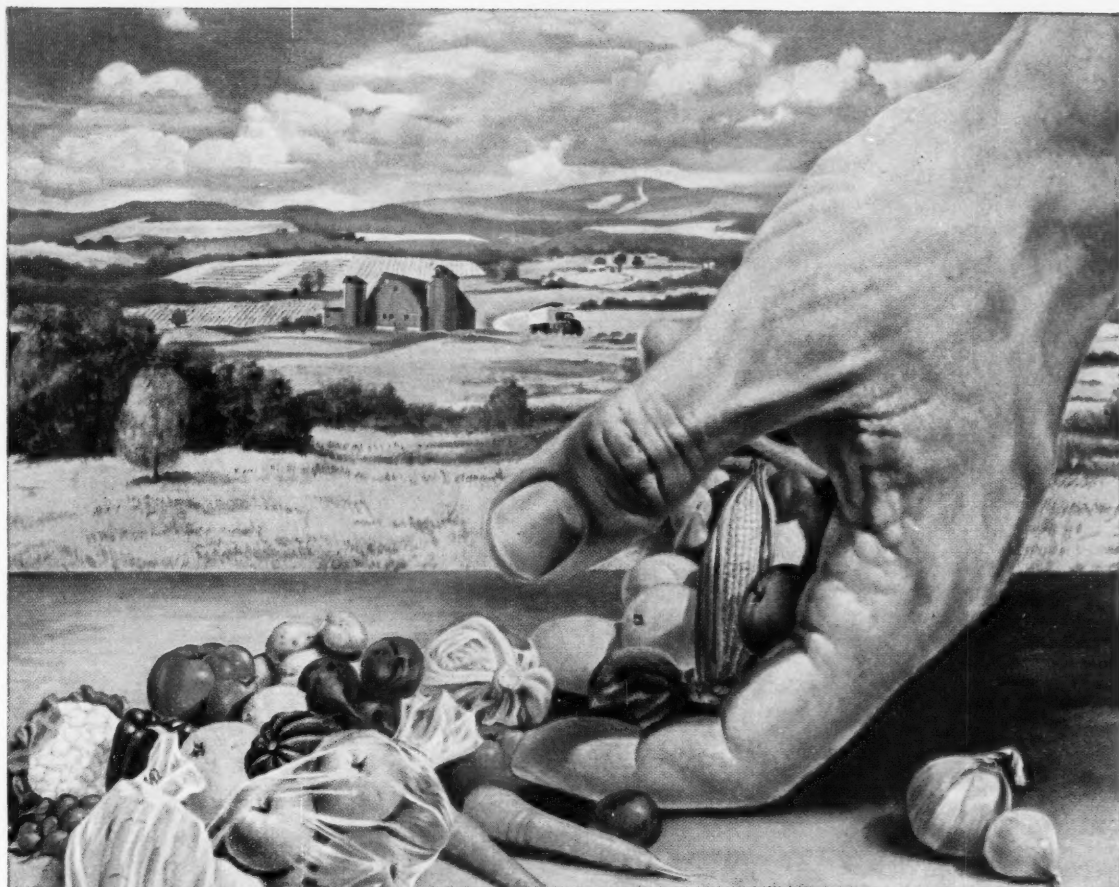
PLEASE PRINT

Name Position

Company

Address

Send DESIGN ENGINEERING for 1 year (\$5) ☐ or 2 years (\$9) ☐ and bill me later.



Farm-fresh to you . . .

How polyethylene plastic helps bring fresher food to your table

A WONDERFULLY useful plastic called polyethylene is now giving a new kind of protection to food that is on its way to your kitchen.

WHEN FOOD IS PACKED in thin, strong bags of "Bakelite" polyethylene, it is able to 'breathe,' and yet not dry out. Because polyethylene has this peculiar advantage, apples, carrots, and other fruits and vegetables—as well as poultry and meat products—can reach your table more nearly farm-fresh than ever.

POLYETHYLENE IS ONLY ONE of a number of plastics produced by the people of Union Carbide to help bring foods to you in prime condition. Some of these

plastics coat cardboard for milk cartons and frozen food packages, while others line the tins for canned foods and beverages.

SCIENCE 'SETS A GOOD TABLE'. These and other materials produced by UCC help protect food while growing, in storage, during preparation, when packaged for your use, and when stored in your pantry or refrigerator. This protection helps provide a more healthful diet for everyone.

FREE: Learn how ALLOYS, CARBON PRODUCTS, CHEMICALS; GASES, and PLASTICS improve many things that you use. Ask for 'Man-Made Miracles' booklet 00.

"Bakelite" is a registered trade mark

UNION CARBIDE CANADA LIMITED

2221 YONGE STREET



TORONTO 7, CANADA

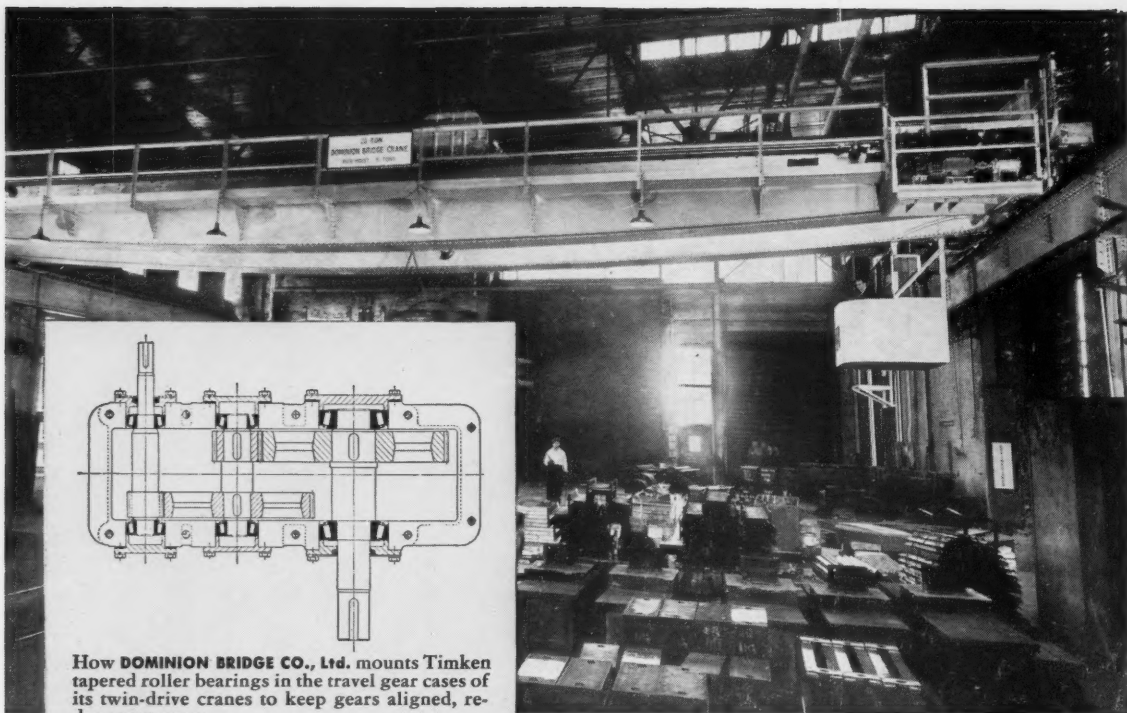
ALLOYS AND METALS
Electro Metallurgical Co.
Welland

CARBON PRODUCTS
National Carbon Company
Toronto

OPERATING DIVISIONS
CHEMICALS
Carbide Chemicals Company
Montreal

INDUSTRIAL GASES
Linde Air Products Co.
Toronto

PLASTICS
Bakelite Company
Belleville



How **DOMINION BRIDGE CO., Ltd.** mounts Timken tapered roller bearings in the travel gear cases of its twin-drive cranes to keep gears aligned, reduce gear wear.

"We've used TIMKEN bearings for 28 years to cut friction, keep our cranes on the go!"
...says Dominion Bridge Company, Ltd.

ENGINEERS of Dominion Bridge Co., Ltd., Canada's oldest crane manufacturer specified 20 Timken tapered roller bearings to keep this 20-ton heavy duty overhead traveling crane operating efficiently with minimum friction. Dominion Bridge has used Timken bearings for over 28 years in many of their general and heavy duty crane designs to take the heavy loads from all directions—keep cranes on the go.

Timken bearings provide extra load-carrying capacity because they have

full line contact between rollers and races. And because Timken bearings are tapered, they take both radial and thrust loads in any combination. No extra thrust devices are needed.

Timken bearings practically eliminate friction because they're designed by geometrical law to have true rolling motion, and they're manufactured with microscopic accuracy to live up to their design, have a super-smooth surface finish. To further insure quality, we even make the steel

that goes into Timken bearings.

Like Dominion Bridge Company, you'll find it to your advantage to specify Timken bearings in the equipment *you* build or buy. Look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. **CANADIAN PLANT:** St. Thomas, Ontario. Cable address: "TIMROSCO".



This symbol on a product means its bearings are the best.

TIMKEN *Made in* **CANADA**
TRADE-MARK REG. IN CANADA AND U. S. PAT. OFF.
TAPERED ROLLER BEARINGS
FOR CANADIAN INDUSTRY



NOT JUST A BALL ○ NOT JUST A ROLLER □ THE TIMKEN TAPERED ROLLER □ BEARING TAKES RADIAL ○ AND THRUST —(□)— LOADS OR ANY COMBINATION —(○)—

